INSTALLATION MANUAL

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SEE THE FOLLOWING PAGES FOR A COMPLETE TABLE OF CONTENTS.

NOTES, CAUTIONS AND WARNINGS

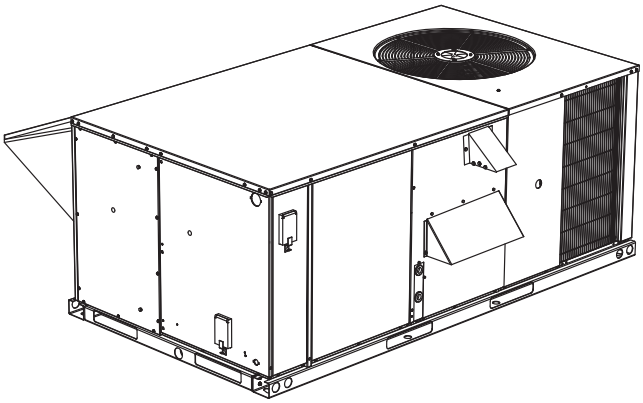
The installer should pay particular attention to the words: *NOTE*, *CAUTION*, and *WARNING*. Notes are intended to clarify or make the installation easier. Cautions are given to prevent equipment damage. Warnings are given to alert installer that personal injury and/or equipment damage may result if installation procedure is not handled properly.

CAUTION: READ ALL SAFETY GUIDES BEFORE YOU BEGIN TO INSTALL YOUR UNIT.

SAVE THIS MANUAL

SUNLINE™ GAS/ELECTRIC SINGLE PACKAGE AIR CONDITIONERS

DM 072
DF 072



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GENERAL

YORK Model DM and DF units are either single package cooling units equipped with optional factory installed electric heaters, or single package gas-fired central heating furnaces with cooling unit. Both are designed for outdoor installation on a rooftop or slab.

The units are completely assembled on rigid, permanently attached base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require electric power, gas connection, duct connections, installation of combustion air inlet hood, flue gas outlet hoods and fixed outdoor air intake damper (units without economizer or motorized damper option only) at the point of installation.

The supplemental electric heaters have nickel-chrome elements and utilize single point power connection.

The gas-fired heaters have aluminized-steel (or optional stainless steel) tubular heat exchangers. The units have spark ignition with proven pilot. All gas heaters are shipped from the factory equipped for natural gas use, but can be field converted to L.P./ Propane with Kit Model # 1NP0440 for single stage and Kit Model # 1NP0485 for 2 stage.

SAFETY CONSIDERATIONS

Due to system pressure, moving parts and electrical components, installation and servicing of air conditioning equipment can be hazardous. Only qualified, trained, service personnel should install, repair, maintain or service this equipment.

Observe all precautions in the literature, on labels and tags accompanying the equipment whenever working on air conditioning equipment. Be sure to follow all other safety precautions that apply.

Wear safety glasses and work gloves, and follow all safety codes. Use a quenching cloth and have a fire extinguisher available for all brazing operations.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury, death, or property damage.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

- WHAT TO DO IF YOU SMELL GAS:
  - Do not try to light any appliance.
  - Do not touch any electrical switch; do not use any phone in your building.
  - Leave the building immediately.
  - Immediately call your gas supplier from a neighbor’s phone. Follow the gas supplier’s instructions.
  - If you cannot reach the gas supplier, call the fire department.

- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing.

REFERENCE

Additional information is available in the following reference forms:

- Technical Guide - DM072, 392856
- Technical Guide - DF072, 254599
- General Installation - DM072, DF072, 364987

RENEWAL PARTS

Contact your local York® parts distribution center for authorized replacement parts.

APPROVALS

Design listed by CSA as follows:

- For use as a cooling unit only with or without optional electric heat.
- For use as a forced air furnace with cooling unit
- For outdoor installation only.
- For installation on combustible material.
- For use with natural gas or propane gas.

⚠ CAUTION

This product must be installed in strict compliance with the enclosed installation instructions and any applicable local, state, and national codes including, but not limited to, building, electrical, and mechanical codes.

⚠ WARNING

Improper installation may create a condition where the operation of the product could cause personal injury or property damage.

The installer should pay particular attention to the words: NOTE, CAUTION and WARNING. Notes are intended to clarify or make the installation easier. Cautions are given to prevent equipment damage. Warnings are given to alert installer that personal injury and/or equipment damage may result if installation procedure is not handled properly.

PRODUCT NOMENCLATURE

6 Ton Sunline Model Number Nomenclature

D	M	072	N04	A	2	A	AA	1	0	1	2	4	A

Product Category
D = A/C, Single Pkg., R-22

Product Identifier
M = 9.0 EER A/C
F = 10.4 EER A/C

Nominal Cooling Capacity
072 = 6.0 Ton

Heat Type and Nominal Heat Capacity
C00 = Cooling Only. Suitable for Field Installed Electric Heat

Gas Heat Options
N08 = 80 MBH Output Aluminized Steel, 1 Stage (072)
N10 = 100 MBH Output Aluminized Steel, 1 Stage (072)
D06 = 60 MBH Output Aluminized Steel, 2 Stage (072)
D10 = 100 MBH Output Aluminized Steel, 2 Stage (072)
S08 = 80 MBH Output Stainless Steel, 1 Stage (072)
S10 = 100 MBH Output Stainless Steel, 1 Stage (072)
T06 = 60 MBH Output Stainless Steel, 2 Stage (072)
T10 = 100 MBH Output Stainless Steel, 2 Stage (072)

Electric Heat Options
E05 = 5 KW
E07 = 7 KW
E10 = 10 KW
E15 = 15 KW
E20 = 20 KW
E30 = 30 KW

Airflow
A = Direct Drive
B = Direct Drive/Economizer
D = Direct Drive/Motorized Damper
N = Belt Drive
P = Belt Drive/Economizer
R = Belt Drive/Motorized Damper
T = Belt Drive High Static
U = Belt Drive High Static/Economizer
V = Belt Drive High Static/Motorized Damper

Voltage
2 = 208/230-3-60
4 = 460-3-60
5 = 575-3-60
7 = 380/415-3-50

Installation Options
A = No Options Installed
B = Option 1
C = Option 2
D = Options 1 & 2
E = Option 3
F = Option 4
G = Options 1 & 3
H = Options 1 & 4
J = Options 1, 2 & 3
K = Options 1, 2, & 4
L = Options 1,3 & 4
M = Options 1, 2, 3, & 4
N = Options 2 & 3
P = Options 2 & 4
Q = Options 2, 3, & 4
R = Options 3 & 4
S = Option 5
T = Options 1 & 5
U = Options 1, 3, & 5
V = Options 1, 4, & 5
W = Options 1, 3, 4, & 5
X = Options 3 & 5
Y = Options 4 & 5
Z = Options 3, 4 & 5

Options
1 = Disconnect
2 = Non-Pwr'd Conv. Outlet
3 = Smoke Detector S.A.
4 = Smoke Detector R.A.
5 = Pwr'd Conv. Outlet

Product Generation
1 = First Generation
2 = Second Generation
3 = Third Generation

Additional Options

Standard Cabinet	Hinged Filter Door & Toolless Access Cabinet
AA = None AB = Phase Monitor AC = Coil Guard AD = Dirty Filter Switch AE = Phase Monitor & Coil Guard AF = Phase Monitor & Dirty Filter Switch AG = Coil Guard & Dirty Filter Switch AH = Phase Monitor, Coil Guard & Dirty Filter Switch AS = Bottom Drain Connection RC = Coil Guard & American Flag TA = Technicoat Condenser Coil TJ = Technicoat Evaporator Coil TS = Technicoat Evaporator and Condenser Coil	**BA = Hinged Filter Door & Toolless Access Panels** BA = Hinged Filter Door & Toolless Access Panels BB = Phase Monitor, Hinged Filter Door & Toolless Access Panels BC = Coil Guard, Hinged Filter Door & Toolless Access Panels BD = Dirty Filter Switch, Hinged Filter Door & Toolless Access Panels BE = Phase Monitor & Coil Guard, Hinged Filter Door & Toolless Access Panels BF = Phase Monitor & Dirty Filter Switch, Hinged Filter Door & Toolless Access Panels BG = Coil Guard & Dirty Filter Switch, Hinged Filter Door & Toolless Access Panels BH = Phase Monitor, Coil Guard & Dirty Filter Switch, Hinged Filter Door & Toolless Access Panels

ZZ = If desired option combination is not listed above, ZZ will be assigned and configuration options will be located in digits 15-18.

Configuration Options (not required for all units)
These four digits will not be assigned until a quote is requested, or an order placed.

- SS Drain Pan
- CPC Controller, DFS, APS
- Johnson Controller UNT 1126 (N2 protocol), DFS, APS
- Honeywell Controller, DFS, APS
- Novar Controller, DFS, APS
- Simplicity IntelliComfort Controller
- Simplicity IntelliComfort Controller w/ModLinc
- York Commercial Comfort System (YCCS) Rtu Controller
- 2" Pleated filters
- BAS Ready Economizer (2-10 V. D. C. Actuator without a Controller)
- Any Combination of Additional Options that Don't Have an Option Code Pre-assigned

Product Style
A = Style A

INSTALLATION

INSTALLATION SAFETY INFORMATION:

Read these instructions before continuing this appliance installation. This is an outdoor combination heating and cooling unit. The installer must assure that these instructions are made available to the consumer and with instructions to retain them for future reference.

1. Refer to the furnace rating plate for the approved type of gas for this furnace.
2. Install this furnace only in a location and position as specified on page 9 of these instructions.
3. Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when checking all connections.
4. Always install furnace to operate within the furnace's intended temperature-rise range with the duct system and within the allowable external static pressure range, as specified on the unit name/rating plate.
5. This equipment is not to be used for temporary heating or cooling of buildings or structures under construction.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

LIMITATIONS

These units must be installed in accordance with the following national and local safety codes:

In U.S.A.:

- National Electrical Code ANSI/NFPA No. 70.
- National Fuel Gas Code Z223.1.
- Gas-Fired Central Furnace Standard ANSI Z21.47a.
- Local gas utility requirements.

In Canada:

- Current Canadian Electrical Code C22.1.
- Current Gas Installation Codes CSA-B149.1.
- Local plumbing and waste water codes.
- Other applicable local codes.

Refer to the Unit Application Data Table 1 and to the Gas Heat Application Data Table 4.

If components are to be added to a unit to meet local codes, they are to be installed at the dealer's and/or the customer's expense.

Size of unit for proposed installation should be based on heat loss/heat gain calculation made according to the methods of the Air Conditioning Contractors of America (ACCA).

⚠ CAUTION

The Simplicity® control board used in this product will effectively operate the cooling system down to 0°F when this product is applied in a comfort cooling application for people. An economizer is typically included in this type of application. When applying this product for process cooling applications (computer rooms, switchgear, etc.), please reference applications bulletin AE-011-07 or call the applications department for Unitary Products @ 1-877-UPG-SERV for guidance. Additional accessories may be needed for stable operation at temperatures below 30° F.

TABLE 1: UNIT APPLICATION DATA (DM, DF)

UNIT MODEL NUMBER		072
Voltage Variation, Min. / Max.[1]	208/230	187 / 252
	460	432 / 504
	575	540 / 630
Supply Air CFM, Nom.		1200
Wet Bulb Temperature (ºF) of Air on Evaporator Coil, Min. / Max		57 / 72
Dry Bulb Temperature (ºF) of Air on Condenser Coil, Min. / Max.		0 / 120

1. Utilization range “A” in accordance with ARI Standard 110.

LOCATION

Use the following guidelines to select a suitable location for these units.

1. Unit is designed for outdoor installation only.
2. Condenser coils must have an unlimited supply of air.
3. Where a choice of location is possible, position the unit on either north or east side of building.
4. For ground level installation, use a level concrete slab with a minimum thickness of 4 inches. The length and width should be at least 6 inches greater than the unit base rails. Do not tie slab to the building foundation.
5. Roof structures must be able to support the weight of the unit and its options and/or accessories. Unit must be installed on a solid level roof curb or appropriate angle iron frame.
6. Maintain level tolerance to 1/2 inch maximum across the entire length or width of the unit.

⚠WARNING

Excessive exposure of this furnace to contaminated combustion air may result in equipment damage or personal injury. Typical contaminates include: permanent wave solutions, chlorinated waxes and cleaners, chlorine based swimming pool chemicals, water softening chemicals, carbon tetrachloride, Halogen type refrigerants, cleaning solvents (e.g. perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, antistatic fabric softeners for clothes dryers, masonry acid washing materials.

If a unit is to be installed on a roof curb or special frame other than a YORK roof curb, gasketing must be applied to all surfaces that come in contact with the unit underside.

RIGGING AND HANDLING

Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the lifting holes provided in the base rails. Spreader bars, whose length exceeds the largest dimension across the unit, MUST BE USED.

Units may also be moved or lifted with a forklift. Slotted openings in the base rails are provided for this purpose. Fork lengths must be a minimum of 42 inches.

Remove the nesting brackets from the four corners on the top of the unit. All screws that are removed when removing the brackets must be replaced on the unit.

Refer to Tables 10 and 12 for unit weights and to the Figure 9 for approximate center of gravity.

⚠ CAUTION

Before lifting a unit, make sure that all panels are in place and that its weight is distributed equally on all cables so it will lift evenly.

CLEARANCES

All units require certain clearances for proper operation and service. Installer must make provisions for adequate combustion and ventilation air in accordance with Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 (in U.S.A.) or Sections 7.2, 7.3 or 7.4 of Gas Installation Codes CSA-B149.1 (in Canada) and/or applicable provisions of the local building codes. Refer to Dimensions and Clearances shown in Figures 10 through 14 and Tables 27 and 28 for the clearances required for combustible construction, servicing, and proper unit operation.

⚠WARNING

Do not permit overhanging structures or shrubs to obstruct outdoor air discharge outlet, combustion air inlet or vent outlets.

DUCTWORK

Ductwork should be designed and sized according to the methods in Manual Q of the Air Conditioning Contractors of America (ACCA).

A closed return duct system shall be used. This shall not preclude use of economizers or outdoor fresh air intake. The supply and return air duct connections at the unit should be made with flexible joints to minimize noise.

The supply and return air duct systems should be designed for the CFM and static requirements of the job. They should NOT be sized to match the dimensions of the duct connections on the unit.

⚠ CAUTION

When fastening ductwork to side duct flanges on unit, insert screws through duct flanges only. DO NOT insert screws through casing. Outdoor ductwork must be insulated and waterproofed.

Refer to Figures 10 through 14 for information concerning side and bottom supply and return air duct openings.

NOTE: It is recommended that, in Canada, the outlet duct be provided with a removable access panel. It is recommended that this opening be accessible when the unit is installed in service, and of a size such that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The cover should be attached in a manner adequate to prevent leakage.

CONDENSATE DRAIN

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install a condensate drain line from the 3/4” NPT female connection on the unit to an open drain.

NOTE: The condensate drain operates in a negative pressure in the cabinet. The condensate drain line MUST be trapped to provide proper drainage. See Figure 1.

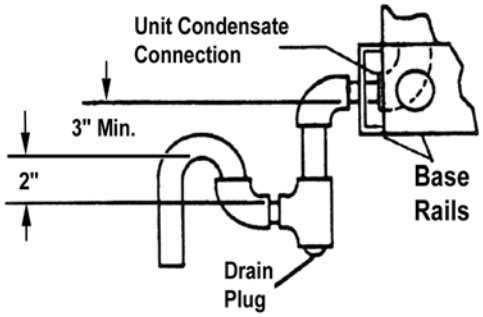


FIGURE 1 - RECOMMENDED DRAIN PIPING

COMPRESSORS

Units are shipped with compressor mountings factory-adjusted and ready for operation.

Units with scroll compressors have a shipping bracket which must be removed after the unit is set in place. See Figure 2.

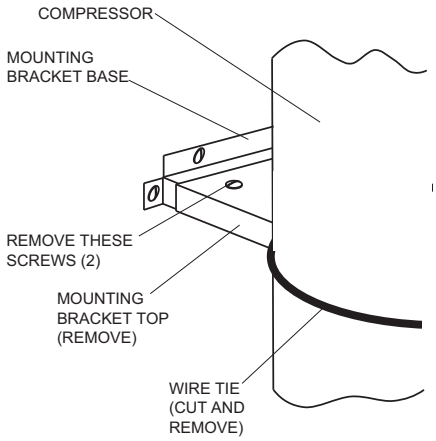


FIGURE 2 - COMPRESSOR RESTRAINING BRACKET

⚠ CAUTION

Do not loosen compressor mounting bolts.

FILTERS

One-inch or two-inch filters can be supplied with each unit. Filters must always be installed ahead of the evaporator coil and must be kept clean or replaced with same size and type. Dirty filters will reduce the capacity of the unit and will result in frosted coils or safety shut-down. Minimum filter area and required sizes are shown in Physical Data Tables 9 and 11.

SERVICE ACCESS

The following removable panels provide access to all serviceable components:

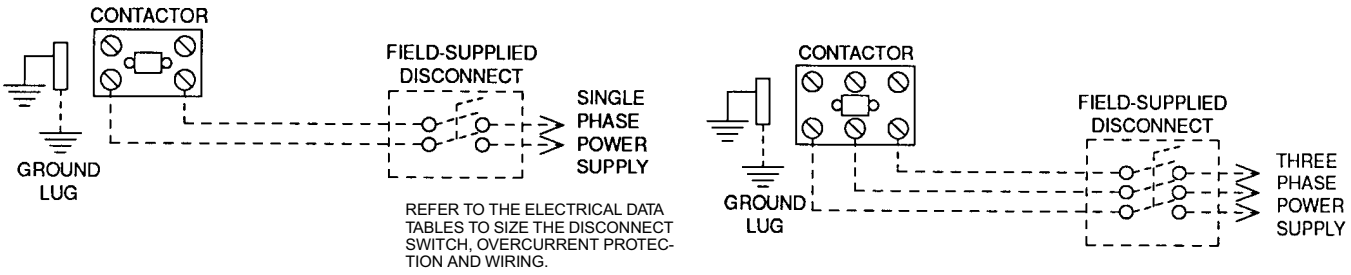
- Compressor compartment
- Electric Heat compartment
- Gas Heat compartment
- Blower compartment
- Main control box
- Filter compartment

Refer to the Dimensions and Clearances shown in Figures 10, 11, 13 and 14 for location of these access panels.

⚠ CAUTION

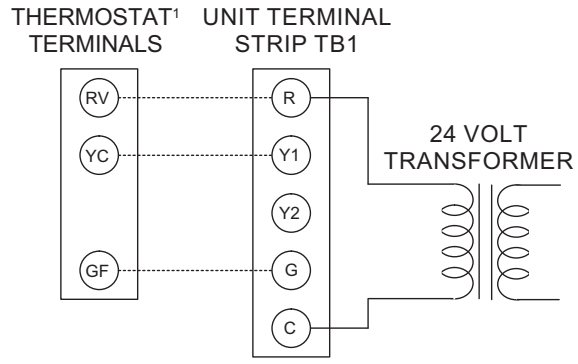
Make sure that all screws and panel latches are replaced and properly positioned on the unit to maintain an airtight seal.

TYPICAL POWER WIRING



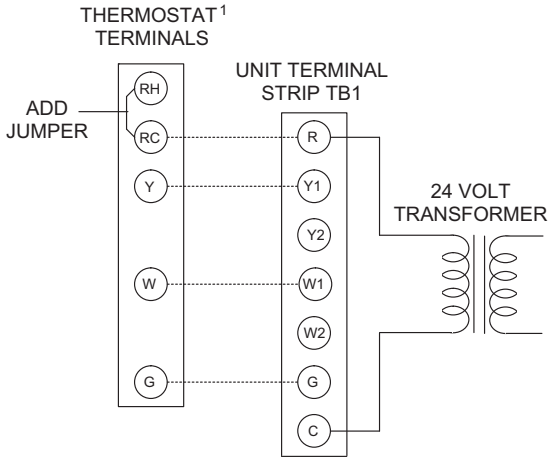
TYPICAL CONTROL WIRING

COOLING ONLY (24 VOLT THERMOSTAT)



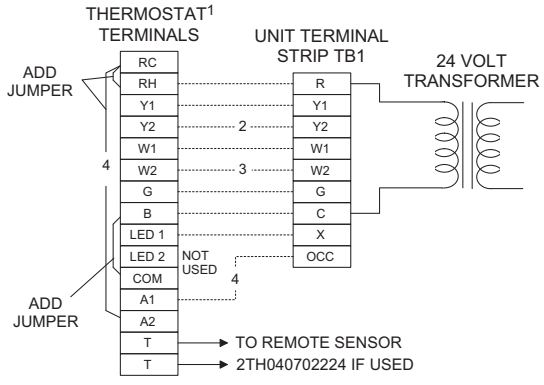
[1]24 VOLT THERMOSTAT 2TH07701024. TO CONTROL THE ECONOMIZER ON SECOND STAGE COOLING, USE THE THERMOSTAT 2TH0401224.

COOLING / HEATING (24 VOLT THERMOSTAT)



[1]24 VOLT THERMOSTAT 2ET07701024. TO CONTROL THE ECONOMIZER ON THE SECOND STAGE COOLING OR TO HAVE AN ELECTRIC HEAT ACCESSORY WITH TWO STAGES OF HEAT, USE THERMOSTAT 2TH0471024.

COOLING / HEATING (ELECTRONIC THERMOSTAT) MULTI STAGE



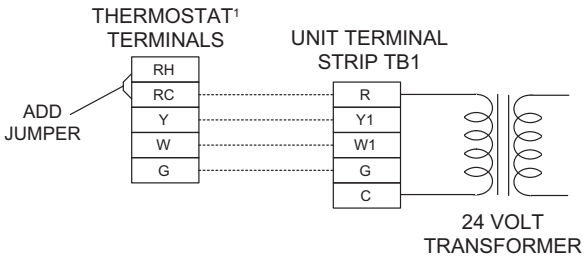
[1] ELECTRONIC PROGRAMMABLE THERMOSTAT 2ET04700224 (INCLUDES SUBBASE).

[2] SECOND STAGE COOLING IS NOT REQUIRED ON UNITS LESS ECONOMIZER.

[3] SECOND STAGE HEATING IS ONLY REQUIRED ON UNITS WITH A TWO STAGE ELECTRIC HEATER OR TWO STAGE GAS HEAT.

[4] REMOVE JUMPER J2 FROM TERMINALS 4 AND 9 ON JUMPER PLUG CONNECTOR P6 ON UNITS WITH ECONOMIZER. TERMINALS A1 AND A2 PROVIDE A RELAY OUT-PUT TO CLOSE THE OUTDOOR ECONOMIZER DAMPERS WHEN THE THERMOSTAT SWITCHES TO THE SET-BACK POSITION.

COOLING / HEATING (ELECTRONIC THERMOSTAT) SINGLE STAGE



[1]ELECTRONIC PROGRAMMABLE THERMOSTAT 2ET07701024 (INCLUDES SUBBASE). TO CONTROL THE ECONOMIZER ON SECOND STAGE COOLING, USE THERMOSTAT 2TH04700224.

FIGURE 3 - TYPICAL FIELD POWER & CONTROL WIRING

THERMOSTAT

The room thermostat should be located on an inside wall approximately 56 inches above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow the manufacturer's instructions enclosed with the thermostat for general installation procedure. A minimum of seven color-coded insulated wires (#18 AWG) should be used to connect the thermostat to the unit.

POWER AND CONTROL WIRING

Field wiring to the unit must conform to provisions of the National Electrical Code, ANSI / NFPA No. 70 (in U.S.A.), current Canadian Electrical Code C22.1 (in Canada) and/or local ordinances. The unit must be electrically grounded in accordance with NEC and CEC (as specified above) and/or local codes. Voltage tolerances, which must be maintained at the compressor terminals, during starting and running conditions, are indicated on the unit Rating Plate and the Unit Application Data table.

⚠ CAUTION

208/230-3-60 and 380/415-3-50 units control tranformers are factory wired for 230v and 415v power supply respectively. Change tap on transformer for 208-3-60 or 380-3-50 operation.
See unit wiring diagram.

The internal wiring harness furnished with this unit is an integral part of a CSA design certified unit. Field alteration to comply with electrical codes should not be required.

A fused disconnect switch should be field provided for the unit. The switch must be separate from all other circuits. Wire entry at knockout openings require conduit fittings to comply with NEC (in U.S.A.), CEC (in Canada) and/or local codes. If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram and the same minimum gauge as the replaced wire.

Use copper conductors properly sized to carry the load. Each unit must be wired with a separate branch circuit fed directly from the meter panel and properly fused.

⚠ CAUTION

When connecting electrical power and control wiring to the unit, waterproof type connectors **MUST BE USED** so that water or moisture cannot be drawn into the unit during normal operation. The above waterproofing conditions will also apply when installing a field-supplied disconnect switch.

Refer to the Typical Field Wiring Figure 3 and to the appropriate unit wiring diagram for control circuit and power wiring information.

TABLE 2: CONTROL WIRE SIZES

Wire Size	Maximum Length[1]
18 AWG	150 Feet

1. From the unit to the thermostat and back to the unit.

OPTIONS/ACCESSORIES

ELECTRIC HEAT

The factory- or field-installed heaters are wired for single point power supply. Power supply need only be brought into the single point terminal block and thermostat wiring to the low voltage terminal strip located in the upper portion of the unit control box.

These CSA approved heaters are located within the central compartment of the unit with the heater elements extending into the supply air chamber. Refer to Figure 10 for access panel location.

Fuses are supplied, where required, by the factory. Some KW sizes require fuses and others do not. Refer to Table 3 for minimum CFM limitations and to Tables 13 through 22 for electrical data.

TABLE 3: ELECTRIC HEATER CFM LIMITATIONS

UNITMODEL SIZE NOMINAL TONS	VOLTAGE	MINIMUM SUPPLY AIR CFM					
		HEATER SIZE NOMINAL KW					
		5	7	10	15	20	30
072 (6)	208/230-1-60	1500	1500	1500	1500	1500	1500
	208/230-3-60	1500	1500	1500	1500	1500	1500
	460-3-60	-	1500	1500	1500	1500	1500
	600-3-60	-	-	1500	1500	1500	1500

GAS HEAT

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition with proven pilot.

All gas heaters are shipped from the factory equipped for natural gas use. See Gas Heat Application Data Table.

For natural gas heating installations in locations requiring low NOx emissions, Accessory model 1LN0406 must be used.

TABLE 4: GAS HEAT APPLICATION DATA

GAS HEAT OPTION	INPUT CAPACITY (MBH)	OUTPUT CAPACITY (MBH)	AVAILABLE ON MODELS	GAS RATE[1] (FT^3/HR)	TEMPERATURE RISE °F AT FULL INPUT[2]	
					MIN.	MAX.
N08	100	80	6 TON	93	25	55
N10	125	100	6 TON	116	35	65
D06	75	61	6 TON	70	15	45
D10	125	101	6 TON	116	30	75

NOTE: Gas Heaters are shipped available for natural gas, but can be converted to L.P. with Kit Model No. 1NP0440 or 1NP0485 (2 Stage). All furnaces meet the latest California seasonal efficiency requirements.

1. Based on 1075 Btu/Ft^3.
2. The air flow must be adjusted to obtain a temperature rise within the range shown.

GAS PIPING

Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of run. “National Fuel Gas Code” Z223.1 (in U.S.A.) or the current Gas Installation Codes CSA-B149.1 (in Canada) should be followed in all cases unless superseded by local codes or gas utility requirements. Refer to the Pipe Sizing Table 5.

The heating value of the gas may differ with locality. The value should be checked with the local gas utility.

NOTE: There may be a local gas utility requirement specifying a minimum diameter for gas piping. All units require a 1/2” pipe connection at the entrance fitting.

TABLE 5: GAS PIPE SIZING

LENGTH IN FEET	NOMINAL IRON PIPE SIZE			
	1/2 in.	3/4 in.	1 in.	1-1/4 in.
10	132	278	520	1,050
20	92	190	350	730
30	73	152	285	590
40	63	130	245	500
50	56	115	215	440
60	50	105	195	400
70	46	96	180	370
80	43	90	170	350
90	40	84	160	320
100	38	79	150	305

Maximum capacity of pipe in cubic feet of gas per hour. (Based upon a pressure drop of 0.3 inch water column and 0.6 specific gravity gas).

GAS CONNECTION

The gas supply line can be routed through the knockouts located on the front of the unit or through the opening provided in the unit's base. Refer to Figure 11 to locate these access openings. Typical supply piping arrangements are shown in Figures 4 and 5. All shaded items are field-supplied.

If gas supply line is routed through the unit's base ensure that the burner assembly can be removed for maintenance without disturbing the supply line. The supply piping and fittings must lie below the bottom gas manifold to avoid interference with the burner assembly.

Two grommets are shipped in the blower compartment (in parts bag taped to the blower housing) of every unit with gas heat and should be used in the knockouts when the gas piping penetrates the front of the unit.

After the gas supply piping has been installed, the bottom opening in the unit should be sealed to prevent water from leaking into the building.

Gas piping recommendations:

1. A drip leg and a ground joint union must be installed in the gas piping.

2. When required by local codes, a manual shut-off valve may have to be installed outside of the unit.

3. Use wrought iron or steel pipe for all gas lines. Pipe compound should be applied sparingly to male threads only.

⚠WARNING

Natural gas may contain some propane. Propane, being an excellent solvent, will quickly dissolve white lead or most standard commercial compounds. Therefore, a special pipe compound must be applied when wrought iron or steel pipe is used. Shellac base compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clyde's or John Crane may be used.

4. All piping should be cleaned of dirt and scale by hammering on the outside of the pipe and blowing out the loose dirt and scale. Before initial start-up, be sure that all of the gas lines external to the unit have been purged of air.

5. The gas supply should be a separate line and installed in accordance with all safety codes as prescribed under “Limitations”. After the gas connections have been completed, open the main shut-off valve admitting normal gas pressure to the mains. Check all joints for leaks with soap solution or other material suitable for the purpose. **NEVER USE A FLAME**.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commerically available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

6. The furnace and its individual manual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.48kPa).

   The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.48kPa).

7. A 1/8 inch NPT plugged tap, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the furnace.

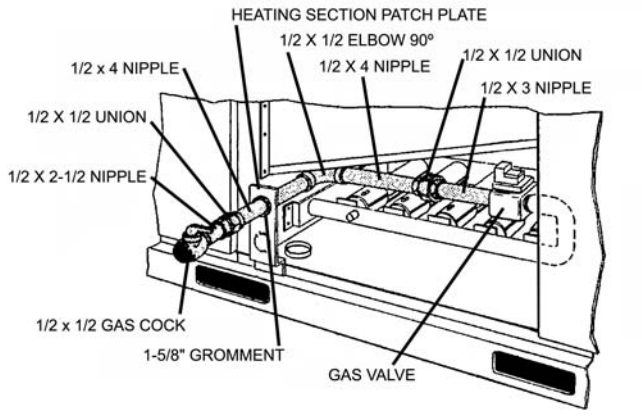


FIGURE 4 - EXTERNAL SUPPLY CONNECTION EXTERNAL SHUT-OFF

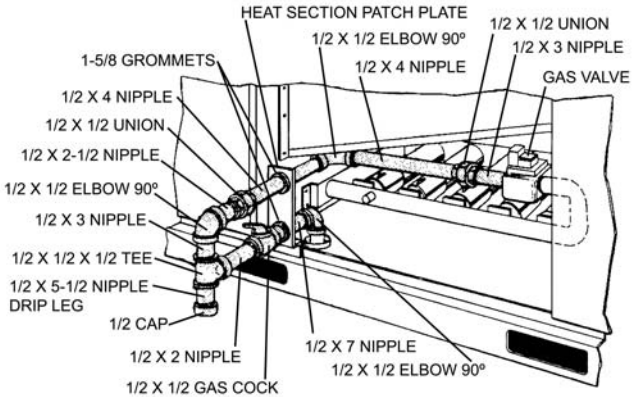


FIGURE 5 - BOTTOM SUPPLY CONNECTION EXTERNAL SHUT-OFF

L.P. UNITS, TANKS AND PIPING

All gas heat units are shipped from the factory equipped for natural gas use only. The unit may be converted in the field for use with L.P./propane gas with accessory kit model number 1NP0440 or 1NP0485 (2 Stage).

All L.P./propane gas equipment must conform to the safety standards of the National Fire Protection Association.

For satisfactory operation, adequate L.P./propane gas pressure must be provided at the unit manifold under full load. Maintaining proper gas pressure depends on three main factors:

1. The vaporization rate depends on (a) the temperature of the liquid and (b) the “wetted surface” area of the container or containers.
2. The proper pressure regulation. (Two-stage regulation is recommended from the standpoint of both cost and efficiency.)
3. The pressure drop in the lines between regulators and between the second stage regulator and the appliance. Pipe size required will depend on the length of the pipe run and the total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and L.P./propane gas suppliers.

L.P./propane gas is an excellent solvent and special pipe compound must be used when assembling piping for this gas as it will quickly dissolve white lead or most standard commercial compounds. Shellac base compounds such as Rectorseal #5 are satisfactory for this type of gas.

Check all connections for leaks when piping is completed, using a soap solution. **NEVER USE A FLAME**.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

VENT AND COMBUSTION AIR HOODS

The vent hood and combustion air hood (with screens) are shipped attached to the blower housing in the blower compartment. These hoods must be installed to assure proper unit function. All hoods must be fastened to the outside of the gas heat access panel with the screws provided in the bag also attached to the blower housing.

The screen for the combustion air intake hood is secured to the inside of the access panel opening with three fasteners and the screws used for mounting the hood to the panel. The top flange of this hood slips in under the top of the access panel opening when installing. Refer to Vent and Combustion Air Hood Figure 6.

The vent hood is installed by inserting the top flange of the hood into the slotted opening in the access panel and securing in place.

The products of combustion are discharged horizontally through this screened, hooded vent openings on the gas heat access panel.

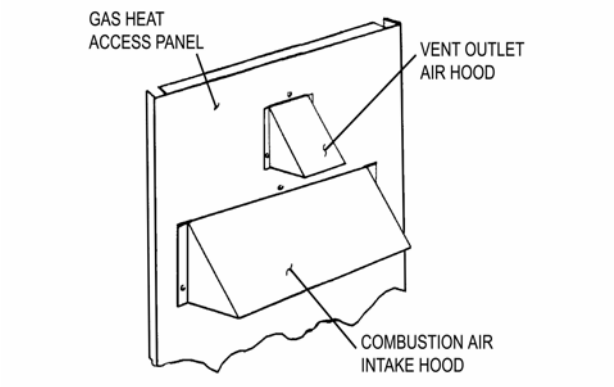


FIGURE 6 - VENT AND COMBUSTION AIR HOOD

⚠ CAUTION

An adhesive backed label is provided over the outside of the combustion air inlet opening to prevent moisture from entering the unit, which could cause damage to electrical components. Allow this closure label to remain in place until the combustion air hood is to be installed.

ECONOMIZER/MOTORIZED DAMPER AND RAIN HOOD

The instruction for the optional economizer/motorized damper and rain hood can be found in form 035-07364-000. Use these instructions when field assembling an economizer rain hood onto a unit. The outdoor and return air dampers, the damper actuator, the damper linkage, the outdoor and return air divider baffles, and all the control sensors are factory mounted as part of the “Factory installed” economizer/motorized damper options.

POWER EXHAUST/BAROMETRIC RELIEF DAMPER AND RAIN HOOD

The instructions for the power exhaust/barometric relief damper and rain hood can be found in form 530.18-N1.10V.

All of the components, including the dampers, hardware, and mounting instructions are shipped in a single package external from the unit and must be field assembled and installed.

Power exhaust is only available as a field installed accessory.

ECONOMIZER AND POWER EXHAUST DAMPER SET POINT ADJUSTMENTS AND INFORMATION

Remove the economizer access panel from the unit. Loosen but do not remove the two panel latches. Locate the economizer control module, where the following adjustments will be made.

⚠ CAUTION

Extreme care must be excercised in turning all setpoint, maximium, and minimum damper positioning adjustment screws to prevent twisting them off.

Check that the damper blades move smoothly without binding; carefully turn the Minimum Position Adjusting screw (found on the damper control module) fully clockwise and then set the thermostat indoor fan switch to the on position and then off, or energize and de-energize terminals “R” to “G”.

MINIMUM POSITION ADJUSTMENT

With thermostat set to indoor fan on position, or terminals “R” to “G” energized, turn the Minimum Position Adjusting screw (located on the damper control module) counterclockwise until the desired minimum damper position has been attained.

ENTHALPY SET POINT ADJUSTMENT

The enthalpy set point may now be set by selecting the desired setpoint shown in the Enthalpy Setpoint Adjustment Figure 7. Adjust as follows:

- For a single enthalpy operation carefully turn the set point adjusting screw (found on the damper control module) to the “A”, “B”, “C” or “D” setting corresponding to the lettered curve of the Enthalpy Setpoint Adjustment Figure 7.
- For a dual enthalpy operation, carefully turn the set point adjusting screw fully clockwise past the “D” setting.

POWER EXHAUST DAMPER SETPOINT (WITH OR WITHOUT POWER EXHAUST)

- With no power exhaust option, adjust the Exhaust Air Adjustment Screw fully clockwise.
- With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer damper position (Percent Open). The Exhaust Air Adjustment Screw should be set at the Percent Open of the economizer damper at which the power exhaust is needed. It can be set from 0 to 100% damper open.

INDOOR AIR QUALITY

Indoor Air quality (indoor sensor input): Terminal AQ accepts a +2 to +10 Vdc signal with respect to the (AQ1) terminal. When the signal is below it's setpoint, the actuator is allowed to modulate normally in accordance with the enthalpy and mixed air sensor inputs. When the AQ signal exceeds it's setpoint setting and there is no call for free cooling, the actuator is proportionately modulated from the 2 to 10 Vdc signal, with 2 Vdc corresponding to full closed and 10 Vdc corresponding to full open. When there is no call for free cooling, the damper position is limited by the IAQ Max damper position setting. When the signal exceeds it's setpoint (Demand Control Ventilation Setpoint) setting and there is a call for free cooling, the actuator modulates from the minimum position to the full open position based on the highest call from either the mixed air sensor input or the AQ voltage input.

- Optional CO_2 Space Sensor Kit Part # 2AQ04700324
- Optional CO_2 Unit Sensor Kit Part # 2AQ04700424

Replace the economizer access panel.

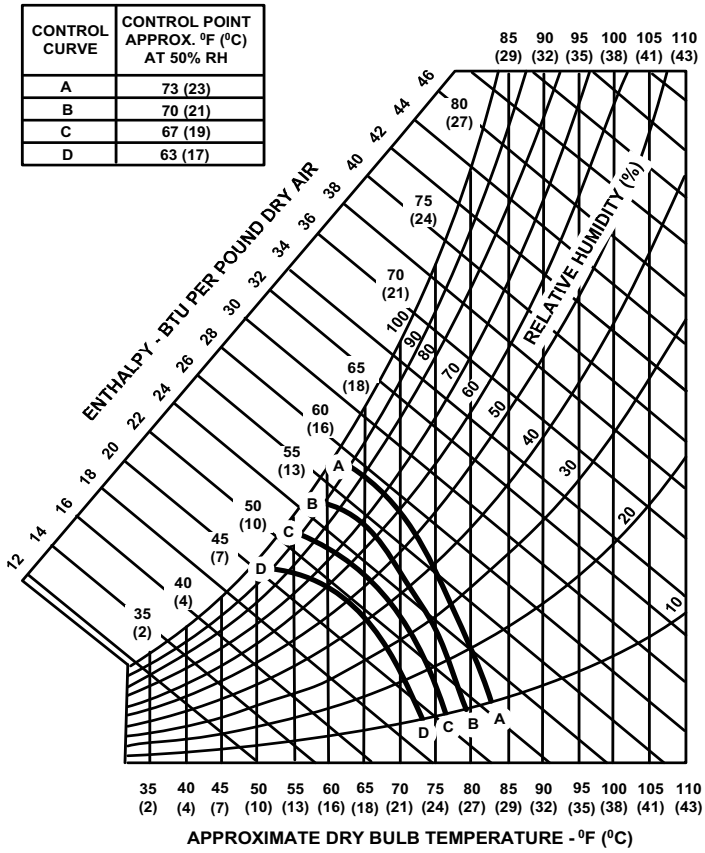

CONTROL CURVE
CONTROL POINT APPROX. °F (°C) AT 50% RH
A 73 (23)
B 70 (21)
C 67 (19)
D 63 (17)
ENTHALPY - BTU PER POUND DRY AIR
RELATIVE HUMIDITY (%)
APPROXIMATE DRY BULB TEMPERATURE - °F (°C)

FIGURE 7 - ENTHALPY SETPOINT ADJUSTMENT

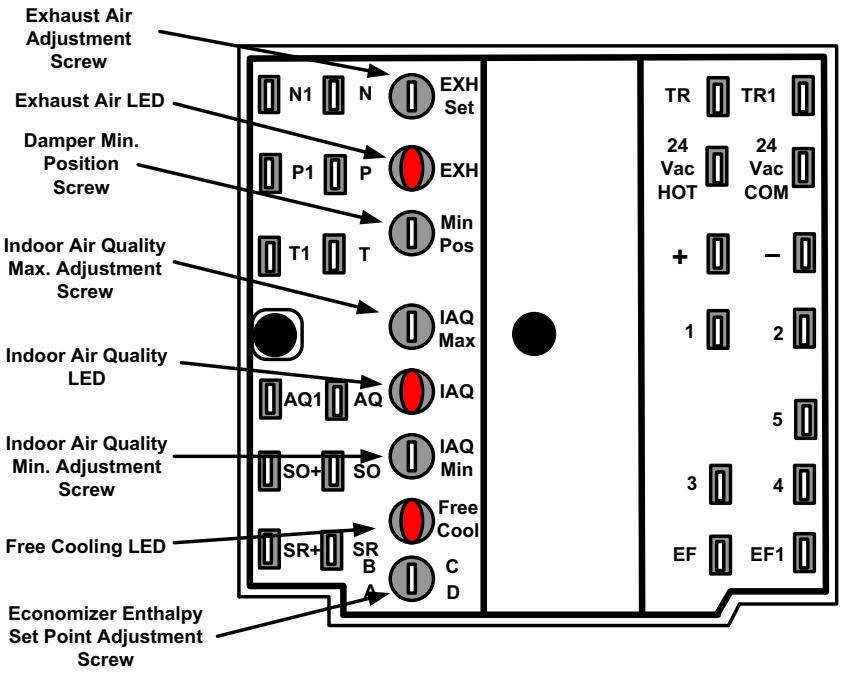


FIGURE 8 - HONEYWELL ECONOMIZER CONTROL W7212

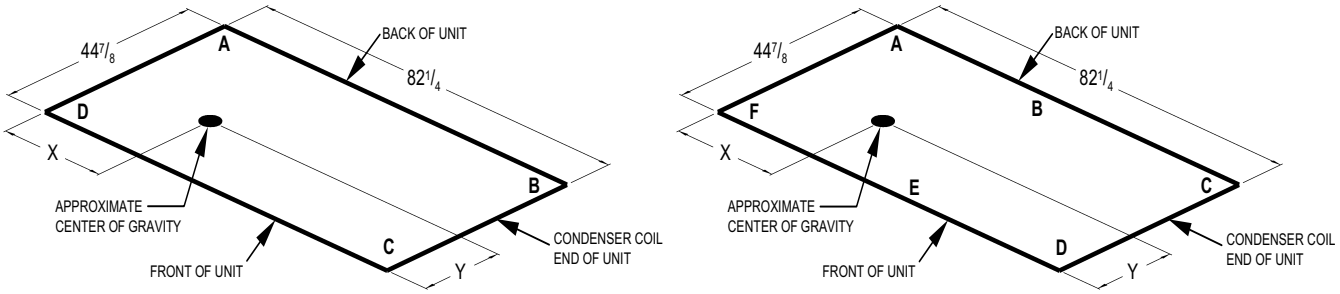


FIGURE 9 - FOUR AND SIX POINT LOADING

TABLE 6: CENTER OF GRAVITY (ALL MODELS)

DIMENSION	6 TON
X	44”
Y	22”

TABLE 7: DM 4 AND 6 POINT LOADS WEIGHT DISTRIBUTION

UNIT	TOTAL	4-Point Loading (lb)				6-Point Loading (lb)					
		A	B	C	D	A	B	C	D	E	F
DM072 Cooling/ Electric	**720**	160	157	200	203	107	106	104	133	134	136
DM072D06	**770**	171	168	214	218	114	113	112	142	144	145
DM072N08	**780**	173	170	216	220	116	114	113	144	146	147
DM072(D,N)10	**790**	175	172	219	223	117	116	114	146	147	149

TABLE 8: DF 4 AND 6 POINT LOADS WEIGHT DISTRIBUTION

UNIT	TOTAL	4-Point Loading (lb)				6-Point Loading (lb)					
		A	B	C	D	A	B	C	D	E	F
DF072 Cooling/ Electric	**660**	147	144	183	186	98	97	96	122	123	125
DF072D06	**710**	158	155	197	201	105	104	103	131	132	134
DF072N08	**720**	160	157	200	203	107	106	104	133	134	136
DF072(D,N)10	**730**	162	159	202	206	108	107	106	135	136	138

TABLE 9: DM PHYSICAL DATA

MODELS		DM
		072
EVAPORATOR BLOWER	Centrifugal Blower (Belt Drive) (Dia. x Wd. in.)	12 X 10
	Centrifugal Blower (Direct Drive) (Dia. x Wd. in.)	12 X 11
	Fan Motor HP (Direct Drive)	1
	Fan Motor HP (Belt Drive)	1 1/2
	Fan Motor HP (Belt Drive High Static)	3
EVAPORATOR COIL	Rows Deep	4
	Fins Per Inch	13
	Face Area (Sq. Ft.)	5.1
CONDENSER FANS	Propeller Dia. (in.)	24
	Fan Motor Hp	1/4
	Nom. CFM	3400
CONDENSER COILS	Rows Deep	2
	Fins Per Inch	16
	Face Area (Sq. Ft.)	16.7
COMPRESSOR (Qty. Per Unit)	Quantity / Type	1 / Scroll
AIR FILTERS	Quantity Per Unit (15" X 20" X 1" or 2")	2
	Quantity Per Unit (14" X 25" X 1" or 2")	1
	Total Face Area (sq. ft.)	6.3
CHARGE	Refrigerant 22 (lbs./oz.)	10/0

TABLE 10: DM OPERATING WEIGHTS (LBS.)

MODEL SIZE			6 TON
BASIC UNIT	DM (Cooling Only)		720
	DM (Gas/Electric)	N08	780
		N10	790
		D06	770
		D10	790
OPTIONS	Economizer		50
	Motorized Damper		26
	Electric Heater	5 - 7 kW	18
		10 - 15 kW	23
		20 - 30 kW	28
ACCY.	Roof Curb		92
	Barometric Relief / Fixed Air Damper		10
	Belt-Drive Blower		5

TABLE 11: DF PHYSICAL DATA

MODELS		DF
		072
EVAPORATOR BLOWER	Centrifugal Blower (Belt Drive) (Dia. x Wd. in.)	12 X 10
	Centrifugal Blower (Direct Drive) (Dia. x Wd. in.)	12 X 11
	Fan Motor HP (Direct Drive)	1
	Fan Motor HP (Belt Drive)	1 1/2
	Fan Motor HP (Belt Drive High Static)	3
EVAPORATOR COIL	Rows Deep	4
	Fins Per Inch	13
	Face Area (Sq. Ft.)	5.1
CONDENSER FANS	Propeller Dia. (in.)	24
	Fan Motor Hp	1/2
	Nom. CFM	4200
CONDENSER COILS	Rows Deep	2
	Fins Per Inch	18
	Face Area (Sq. Ft.)	17.1
COMPRESSOR (Qty. Per Unit)	Recip Type	1
AIR FILTERS	Quantity Per Unit (15” X 20” X 1” or 2“)	2
	Quantity Per Unit (14” X 25” X 1” or 2“)	1
	Total Face Area (sq. ft.)	6.3
CHARGE	Refrigerant 22 (lbs./oz.)	11/10

TABLE 12: DF OPERATING WEIGHTS (LBS.)

MODEL SIZE			6 TON
BASIC UNIT	DF (Cooling Only)		660
	DF (Gas/Electric)	N08	720
		N10	730
		D06	760
		D10	730
OPTIONS	Economizer		50
	Motorized Damper		26
	Electric Heater	5 - 7 kW	18
		10 - 15 kW	23
		20 - 30 kW	28
ACCY.	Roof Curb		92
	Barometric Relief / Fixed Air Damper		10
	Belt-Drive Blower		5

TABLE 13: ELECTRICAL DATA - DM072 DIRECT DRIVE W/O POWERED CONV. OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	18.9	146.0	29.5	1.3	6.8	0.0	None	-	-	-	31.7	40
								E05	4.0	1	11.1	31.7	40
								E07	5.6	1	15.5	31.7	40
								E10	8.0	1	22.2	36.3	50
								E15	11.9	2	33.0	49.8	50
								E20	15.9	2	44.1	63.7	70
								E30	22.2	2	61.6	85.5	90
	230-3-60	18.9	146.0	29.5	1.3	6.8	0.0	None	-	-	-	31.7	40
								E05	5.3	1	13.3	31.7	40
								E07	7.5	1	18.8	31.7	40
								E10	10.6	1	26.6	40.4	50
								E15	15.9	2	39.9	56.3	60
								E20	21.2	2	53.2	72.2	80
								E30	29.6	2	74.3	97.5	100
	460-3-60	9.5	73.0	14.8	0.8	3.6	0.0	None	-	-	-	16.3	25
								E07	6.8	1	8.5	16.3	25
								E10	10.1	1	12.7	19.7	25
								E15	13.6	2	17.1	24.9	25
								E20	19.5	2	24.5	33.8	35
								E30	28.8	2	36.1	47.8	50
	575-3-60	7.6	58.4	11.8	0.8	3.6	0.0	None	-	-	-	13.0	15
								E10	10.6	1	10.6	16.3	20
								E15	15.9	1	16.0	22.7	25
								E20	21.2	2	21.3	29.1	30
								E30	30.4	2	30.5	40.2	40

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 14: ELECTRICAL DATA - DM072 BELT DRIVE W/O POWERED CONV. OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	18.9	146.0	29.5	1.3	5.0	0.0	None	-	-	-	29.9	40
								E05	4.0	1	11.1	29.9	40
								E07	5.6	1	15.5	29.9	40
								E10	8.0	1	22.2	34.0	45
								E15	11.9	2	33.0	47.5	50
								E20	15.9	2	44.1	61.4	70
								E30	22.2	2	61.6	83.3	90
	230-3-60	18.9	146.0	29.5	1.3	5.0	0.0	None	-	-	-	29.9	40
								E05	5.3	1	13.3	29.9	40
								E07	7.5	1	18.8	29.9	40
								E10	10.6	1	26.6	38.1	45
								E15	15.9	2	39.9	54.1	60
								E20	21.2	2	53.2	70.0	70
								E30	29.6	2	74.3	95.3	100
	460-3-60	9.5	73.0	14.8	0.8	2.5	0.0	None	-	-	-	15.2	20
								E07	6.8	1	8.5	15.2	20
								E10	10.1	1	12.7	18.3	20
								E15	13.6	2	17.1	23.6	25
								E20	19.5	2	24.5	32.4	35
								E30	28.8	2	36.1	46.4	50
	575-3-60	7.6	58.4	11.8	0.8	2.0	0.0	None	-	-	-	12.1	15
								E10	10.6	1	10.6	15.2	20
								E15	15.9	1	16.0	21.6	25
								E20	21.2	2	21.3	28.0	30
								E30	30.4	2	30.5	39.1	40

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 15: ELECTRICAL DATA - DM072 BELT DRIVE HIGH STATIC W/O POWERED CONV. OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	18.9	146.0	29.5	1.3	10.9	0.0	None	-	-	-	35.8	50
								E05	4.0	1	11.1	35.8	50
								E07	5.6	1	15.5	35.8	50
								E10	8.0	1	22.2	41.4	50
								E15	11.9	2	33.0	54.9	60
								E20	15.9	2	44.1	68.8	70
								E30	22.2	2	61.6	90.7	100
	230-3-60	18.9	146.0	29.5	1.3	10.9	0.0	None	-	-	-	35.8	50
								E05	5.3	1	13.3	35.8	50
								E07	7.5	1	18.8	36.2	50
								E10	10.6	1	26.6	45.5	50
								E15	15.9	2	39.9	61.4	70
								E20	21.2	2	53.2	77.4	80
								E30	29.6	2	74.3	102.6	110
	460-3-60	9.5	73.0	14.8	0.8	5.3	0.0	None	-	-	-	18.0	25
								E07	6.8	1	8.5	18.0	25
								E10	10.1	1	12.7	21.8	25
								E15	13.6	2	17.1	27.1	30
								E20	19.5	2	24.5	35.9	40
								E30	28.8	2	36.1	49.9	50
	575-3-60	7.6	58.4	11.8	0.8	4.1	0.0	None	-	-	-	14.2	20
								E10	10.6	1	10.6	17.9	20
								E15	15.9	1	16.0	24.2	25
								E20	21.2	2	21.3	30.6	35
								E30	30.4	2	30.5	41.7	45

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 16: ELECTRICAL DATA - DM072 DIRECT DRIVE W/POWERED CONV. OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	18.9	146.0	29.5	1.3	6.8	10.0	None	-	-	-	41.7	60
								E05	4.0	1	11.1	41.7	60
								E07	5.6	1	15.5	41.7	60
								E10	8.0	1	22.2	48.8	60
								E15	11.9	2	33.0	62.3	70
								E20	15.9	2	44.1	76.2	80
								E30	22.2	2	61.6	98.0	100
	230-3-60	18.9	146.0	29.5	1.3	6.8	10.0	None	-	-	-	41.7	60
								E05	5.3	1	13.3	41.7	60
								E07	7.5	1	18.8	43.6	60
								E10	10.6	1	26.6	52.9	60
								E15	15.9	2	39.9	68.8	70
								E20	21.2	2	53.2	84.7	90
								E30	29.6	2	74.3	110.0	125
	460-3-60	9.5	73.0	14.8	0.8	3.6	5.0	None	-	-	-	21.3	30
								E07	6.8	1	8.5	21.3	30
								E10	10.1	1	12.7	25.9	30
								E15	13.6	2	17.1	31.2	35
								E20	19.5	2	24.5	40.1	45
								E30	28.8	2	36.1	54.1	60
	575-3-60	7.6	58.4	11.8	0.8	3.6	4.0	None	-	-	-	17.0	20
								E10	10.6	1	10.6	21.3	25
								E15	15.9	1	16.0	27.7	30
								E20	21.2	2	21.3	34.1	35
								E30	30.4	2	30.5	45.2	45

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 17: ELECTRICAL DATA - DM072 BELT DRIVE W/POWERED CONV. OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	18.9	146.0	29.5	1.3	5.0	10.0	None	-	-	-	39.9	50
								E05	4.0	1	11.1	39.9	50
								E07	5.6	1	15.5	39.9	50
								E10	8.0	1	22.2	46.5	50
								E15	11.9	2	33.0	60.0	70
								E20	15.9	2	44.1	73.9	80
								E30	22.2	2	61.6	95.8	100
	230-3-60	18.9	146.0	29.5	1.3	5.0	10.0	None	-	-	-	39.9	50
								E05	5.3	1	13.3	39.9	50
								E07	7.5	1	18.8	41.3	50
								E10	10.6	1	26.6	50.6	60
								E15	15.9	2	39.9	66.6	70
								E20	21.2	2	53.2	82.5	90
								E30	29.6	2	74.3	107.8	110
	460-3-60	9.5	73.0	14.8	0.8	2.5	5.0	None	-	-	-	20.2	25
								E07	6.8	1	8.5	20.2	25
								E10	10.1	1	12.7	24.6	25
								E15	13.6	2	17.1	29.8	30
								E20	19.5	2	24.5	38.7	40
								E30	28.8	2	36.1	52.7	60
	575-3-60	7.6	58.4	11.8	0.8	2.0	4.0	None	-	-	-	16.1	20
								E10	10.6	1	10.6	20.2	25
								E15	15.9	1	16.0	26.6	30
								E20	21.2	2	21.3	33.0	35
								E30	30.4	2	30.5	44.1	45

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 18: ELECTRICAL DATA - DM072 BELT DRIVE HIGH STATIC W/POWERED CONV. OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	18.9	146.0	29.5	1.3	10.9	10.0	None	-	-	-	45.8	60
								E05	4.0	1	11.1	45.8	60
								E07	5.6	1	15.5	45.8	60
								E10	8.0	1	22.2	53.9	60
								E15	11.9	2	33.0	67.4	70
								E20	15.9	2	44.1	81.3	90
								E30	22.2	2	61.6	103.2	110
	230-3-60	18.9	146.0	29.5	1.3	10.9	10.0	None	-	-	-	45.8	60
								E05	5.3	1	13.3	45.8	60
								E07	7.5	1	18.8	48.7	60
								E10	10.6	1	26.6	58.0	60
								E15	15.9	2	39.9	73.9	80
								E20	21.2	2	53.2	89.9	90
								E30	29.6	2	74.3	115.1	125
	460-3-60	9.5	73.0	14.8	0.8	5.3	5.0	None	-	-	-	23.0	30
								E07	6.8	1	8.5	23.1	30
								E10	10.1	1	12.7	28.1	30
								E15	13.6	2	17.1	33.3	35
								E20	19.5	2	24.5	42.2	45
								E30	28.8	2	36.1	56.2	60
	575-3-60	7.6	58.4	11.8	0.8	4.1	4.0	None	-	-	-	18.2	25
								E10	10.6	1	10.6	22.9	25
								E15	15.9	1	16.0	29.2	30
								E20	21.2	2	21.3	35.6	40
								E30	30.4	2	30.5	46.7	50

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 19: ELECTRICAL DATA - DF072 DIRECT DRIVE W/O POWERED CONVENIENCE OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	20.7	156.0	29.0	2.3	7.6	0.0	None	-	-	-	35.8	50
								E05	4.0	1	11.1	35.8	50
								E07	5.6	1	15.5	35.8	50
								E10	8.0	1	22.2	37.3	50
								E15	11.9	2	33.0	50.8	60
								E20	15.9	2	44.1	64.7	70
								E30	22.2	2	61.6	86.5	90
	230-3-60	20.7	156.0	29.0	2.3	7.6	0.0	None	-	-	-	35.8	50
								E05	5.3	1	13.3	35.8	50
								E07	7.5	1	18.8	35.8	50
								E10	10.6	1	26.6	41.4	50
								E15	15.9	2	39.9	57.3	60
								E20	21.2	2	53.2	73.2	80
								E30	29.6	2	74.3	98.5	100

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 20: ELECTRICAL DATA - DF072 BELT DRIVE W/O POWERED CONVENIENCE OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	20.7	156.0	29.0	2.3	5.2	0.0	None	-	-	-	33.4	45
								E05	4.0	1	11.1	33.4	45
								E07	5.6	1	15.5	33.4	45
								E10	8.0	1	22.2	34.3	45
								E15	11.9	2	33.0	47.8	50
								E20	15.9	2	44.1	61.7	70
								E30	22.2	2	61.6	83.5	90
	230-3-60	20.7	156.0	29.0	2.3	5.2	0.0	None	-	-	-	33.4	45
								E05	5.3	1	13.3	33.4	45
								E07	7.5	1	18.8	33.4	45
								E10	10.6	1	26.6	38.4	50
								E15	15.9	2	39.9	54.3	60
								E20	21.2	2	53.2	70.2	80
								E30	29.6	2	74.3	95.5	100
	460-3-60	10.0	75.0	14.0	1.3	2.6	0.0	None	-	-	-	16.4	25
								E07	6.8	1	8.5	16.4	25
								E10	10.1	1	12.7	18.4	25
								E15	13.6	2	17.1	23.7	25
								E20	19.5	2	24.5	32.6	35
								E30	28.8	2	36.1	46.6	50
	575-3-60	8.2	54.0	11.5	1.3	2.0	0.0	None	-	-	-	13.3	20
								E10	10.6	1	10.6	15.2	20
								E15	15.9	1	16.0	21.6	25
								E20	21.2	2	21.3	28.0	30
								E30	30.4	2	30.5	39.1	40

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 21: ELECTRICAL DATA - DF072 BELT DRIVE HIGH STATIC W/O POWERED CONVENIENCE OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	20.7	156.0	29.0	2.3	10.9	0.0	None	-	-	-	39.1	50
								E05	4.0	1	11.1	39.1	50
								E07	5.6	1	15.5	39.1	50
								E10	8.0	1	22.2	41.4	50
								E15	11.9	2	33.0	54.9	60
								E20	15.9	2	44.1	68.8	70
								E30	22.2	2	61.6	90.7	100
	230-3-60	20.7	156.0	29.0	2.3	10.9	0.0	None	-	-	-	39.1	50
								E05	5.3	1	13.3	39.1	50
								E07	7.5	1	18.8	39.1	50
								E10	10.6	1	26.6	45.5	50
								E15	15.9	2	39.9	61.4	70
								E20	21.2	2	53.2	77.4	80
								E30	29.6	2	74.3	102.6	110
	460-3-60	10.0	75.0	14.0	1.3	5.3	0.0	None	-	-	-	19.1	25
								E07	6.8	1	8.5	19.1	25
								E10	10.1	1	12.7	21.8	25
								E15	13.6	2	17.1	27.1	30
								E20	19.5	2	24.5	35.9	40
								E30	28.8	2	36.1	49.9	50
	575-3-60	8.2	54.0	11.5	1.3	4.1	0.0	None	-	-	-	15.4	20
								E10	10.6	1	10.6	17.9	20
								E15	15.9	1	16.0	24.2	25
								E20	21.2	2	21.3	30.6	35
								E30	30.4	2	30.5	41.7	45

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 22: ELECTRICAL DATA - DF072 DIRECT DRIVE WITH POWERED CONVENIENCE OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	20.7	156.0	29.0	2.3	7.6	10.0	None	-	-	-	45.8	60
								E05	4.0	1	11.1	45.8	60
								E07	5.6	1	15.5	45.8	60
								E10	8.0	1	22.2	49.8	60
								E15	11.9	2	33.0	63.3	70
								E20	15.9	2	44.1	77.2	80
								E30	22.2	2	61.6	99.0	100
	230-3-60	20.7	156.0	29.0	2.3	7.6	10.0	None	-	-	-	45.8	60
								E05	5.3	1	13.3	45.8	60
								E07	7.5	1	18.8	45.8	60
								E10	10.6	1	26.6	53.9	60
								E15	15.9	2	39.9	69.8	70
								E20	21.2	2	53.2	85.7	90
								E30	29.6	2	74.3	111.0	125

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 23: ELECTRICAL DATA - DF072 BELT DRIVE WITH POWERED CONVENIENCE OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	20.7	156.0	29.0	2.3	5.2	10.0	None	-	-	-	43.4	60
								E05	4.0	1	11.1	43.4	60
								E07	5.6	1	15.5	43.4	60
								E10	8.0	1	22.2	46.8	60
								E15	11.9	2	33.0	60.3	70
								E20	15.9	2	44.1	74.2	80
								E30	22.2	2	61.6	96.0	100
	230-3-60	20.7	156.0	29.0	2.3	5.2	10.0	None	-	-	-	43.4	60
								E05	5.3	1	13.3	43.4	60
								E07	7.5	1	18.8	43.4	60
								E10	10.6	1	26.6	50.9	60
								E15	15.9	2	39.9	66.8	70
								E20	21.2	2	53.2	82.7	90
								E30	29.6	2	74.3	108.0	110
	460-3-60	10.0	75.0	14.0	1.3	2.6	5.0	None	-	-	-	21.4	30
								E07	6.8	1	8.5	21.4	30
								E10	10.1	1	12.7	24.7	30
								E15	13.6	2	17.1	29.9	30
								E20	19.5	2	24.5	38.8	40
								E30	28.8	2	36.1	52.8	60
	575-3-60	8.2	54.0	11.5	1.3	2.0	4.0	None	-	-	-	17.3	25
								E10	10.6	1	10.6	20.2	25
								E15	15.9	1	16.0	26.6	30
								E20	21.2	2	21.3	33.0	35
								E30	30.4	2	30.5	44.1	45

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 24: ELECTRICAL DATA - DF072 BELT DRIVE HIGH STATIC WITH POWERED CONVENIENCE OUTLET

Size (Tons)	Volt	Compressors (each)			OD Fan Motors (each)	Supply Blower Motor	Pwr Conv Outlet	Electric Heat Option				MCA[1] (Amps)	Max Fuse[2]/ Breaker[3] Size (Amps)
		RLA	LRA	MCC	FLA	FLA	FLA	Model	kW	Stages	Amps		
072 (6.0)	208-3-60	20.7	156.0	29.0	2.3	10.9	10.0	None	-	-	-	49.1	60
								E05	4.0	1	11.1	49.1	60
								E07	5.6	1	15.5	49.1	60
								E10	8.0	1	22.2	53.9	60
								E15	11.9	2	33.0	67.4	70
								E20	15.9	2	44.1	81.3	90
								E30	22.2	2	61.6	103.2	110
	230-3-60	20.7	156.0	29.0	2.3	10.9	10.0	None	-	-	-	49.1	60
								E05	5.3	1	13.3	49.1	60
								E07	7.5	1	18.8	49.1	60
								E10	10.6	1	26.6	58.0	60
								E15	15.9	2	39.9	73.9	80
								E20	21.2	2	53.2	89.9	90
								E30	29.6	2	74.3	115.1	125
	460-3-60	10.0	75.0	14.0	1.3	5.3	5.0	None	-	-	-	24.1	30
								E07	6.8	1	8.5	24.1	30
								E10	10.1	1	12.7	28.1	30
								E15	13.6	2	17.1	33.3	35
								E20	19.5	2	24.5	42.2	45
								E30	28.8	2	36.1	56.2	60
	575-3-60	8.2	54.0	11.5	1.3	4.1	4.0	None	-	-	-	19.4	25
								E10	10.6	1	10.6	22.9	25
								E15	15.9	1	16.0	29.2	30
								E20	21.2	2	21.3	35.6	40
								E30	30.4	2	30.5	46.7	50

1. Minimum Circuit Ampacity.
2. Dual Element, Time Delay Type.
3. HACR type per NEC.

TABLE 25: ELECTRIC HEAT CORRECTION FACTORS

NOMINAL VOLTAGE	VOLTAGE	kW CAP. MULTIPLIER
208	208	0.75
240	230	0.92
480	460	0.92
600	575	0.92

TABLE 26: VOLTAGE LIMITATIONS[1]

POWER SUPPLY	VOLTAGE	
	MIN.	MAX.
208/230-3-60	187	252
460-3-60	432	504
575-3-60	540	630

1. Utilization Range “A” in accordance with ARI Standard 110.

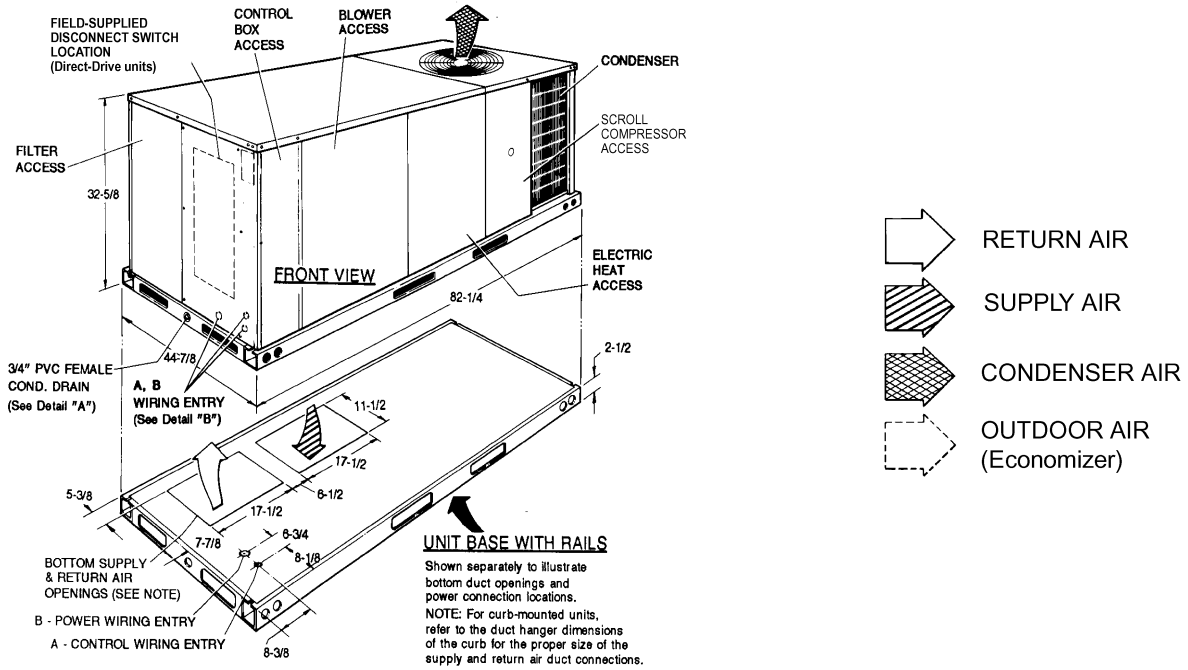


FIGURE 10 - UNIT DIMENSIONS (6 TON COOLING ONLY/ELECTRIC HEAT) FRONT VIEW

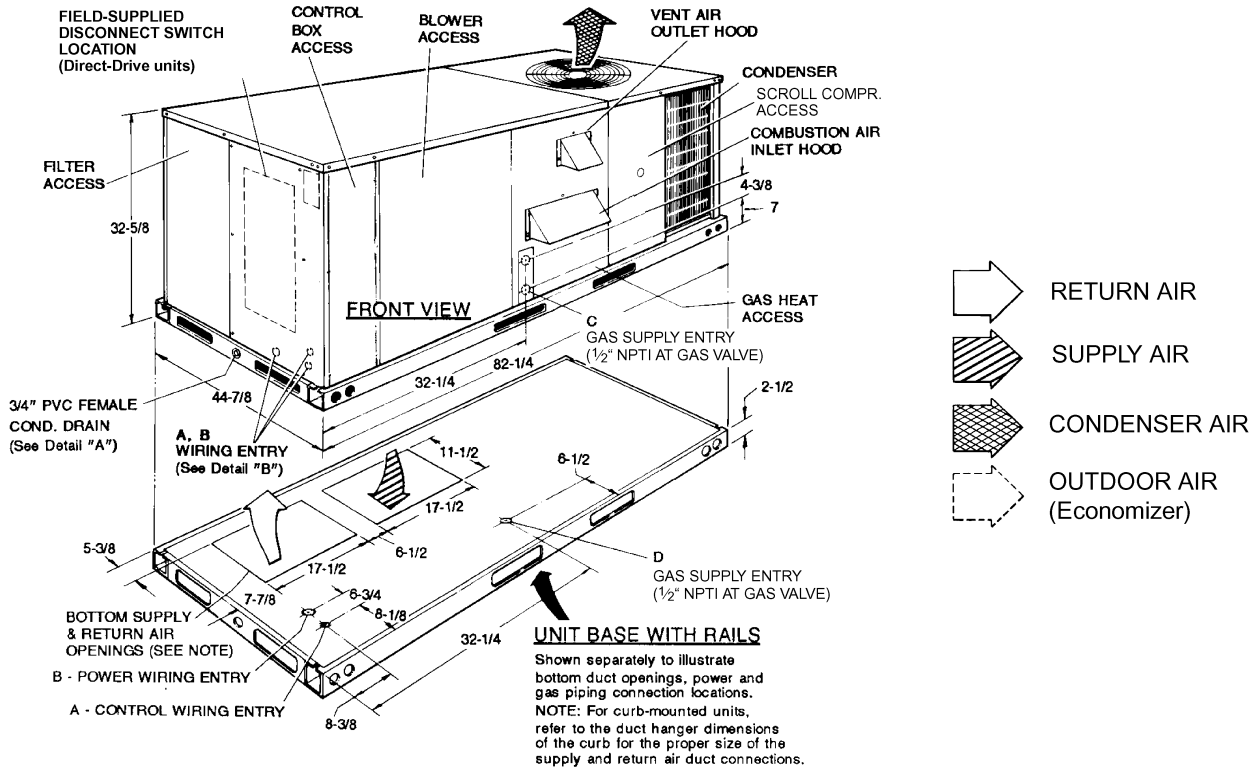


FIGURE 11 - UNIT DIMENSIONS (6 TON COOLING/GAS HEAT) FRONT VIEW

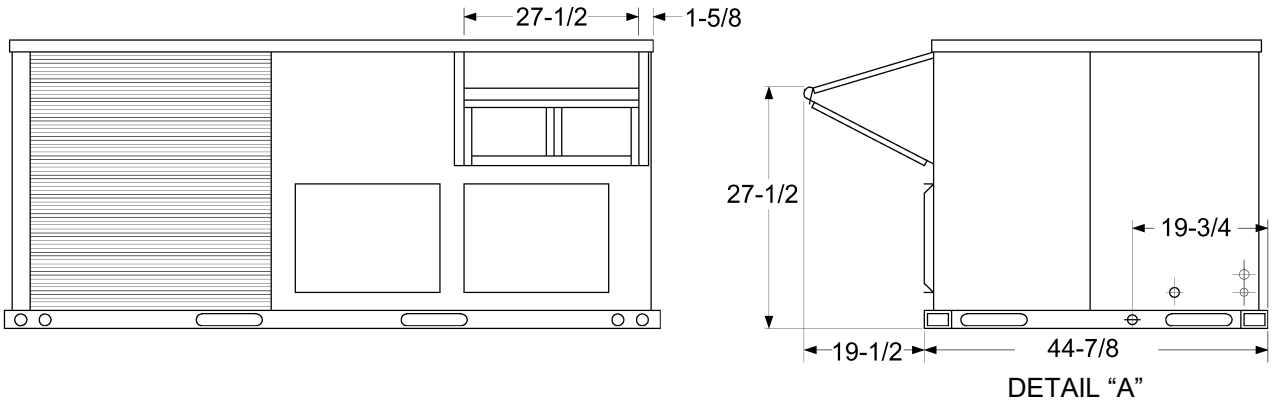
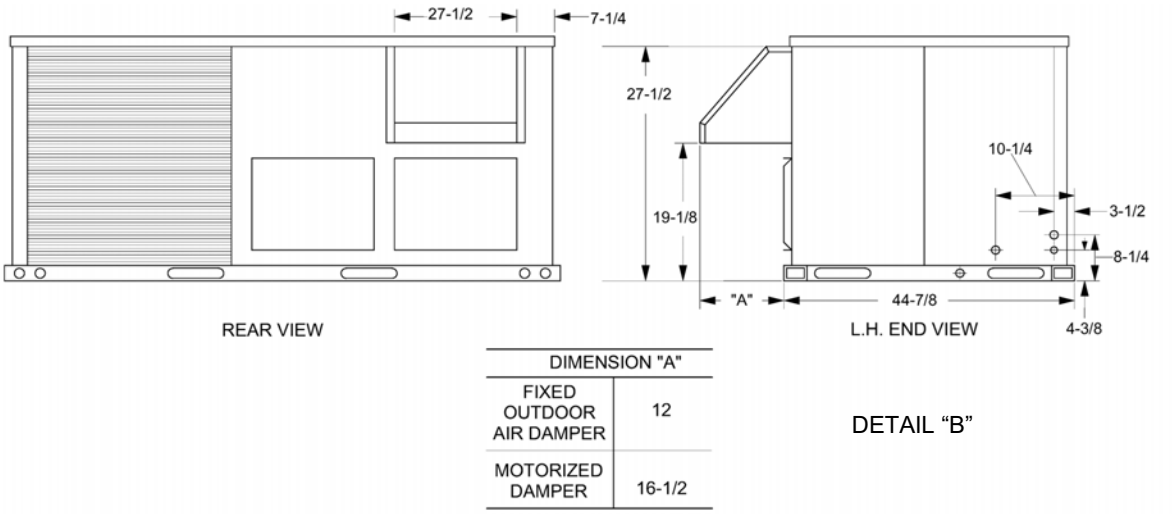
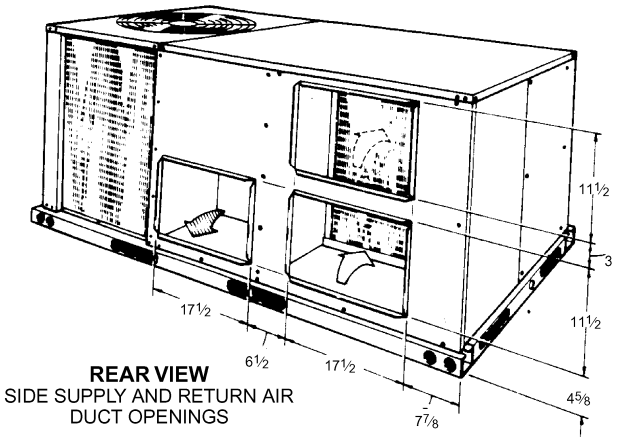


FIGURE 12 - UNIT WITH ECONOMIZER RAINHOOD



DIMENSION "A"	
FIXED OUTDOOR AIR DAMPER	12
MOTORIZED DAMPER	16-1/2

FIGURE 13 - UNIT WITH FIXED OUTDOOR AIR/MOTORIZED DAMPER RAINHOOD



DUCT COVERS - Units are shipped with all air duct openings covered.
For side duct applications;
1. Remove and discard the supply and return air duct covers.
2. Connect ductwork to duct flanges on the rear of the unit.

For bottom duct applications;
1. Remove the side supply air duct cover to gain access to the bottom supply air knockout panel.
2. Remove and discard the bottom knockout panel.
3. Replace the side duct cover.
4. With filter section access panel removed from the unit, remove and discard the bottom return air knockout panel.
5. Replace the filter access panel.

FIGURE 14 - UNIT DIMENSIONS (REAR VIEW)

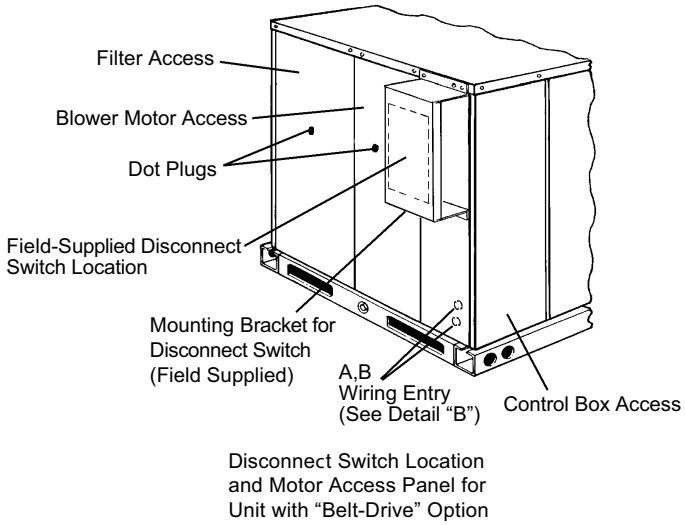

Filter Access
Blower Motor Access
Dot Plugs
Field-Supplied Disconnect Switch Location
Mounting Bracket for Disconnect Switch (Field Supplied)
A,B Wiring Entry (See Detail "B")
Control Box Access
Disconnect Switch Location and Motor Access Panel for Unit with "Belt-Drive" Option

FIGURE 15 - DISCONNECT/BLOWER ACCESS LOCATION

TABLE 27: UTILITIES ENTRY

HOLE	OPENING SIZE (DIA.)	USED FOR	
A	7/8" KO[1]	Control Wiring[2]	Side
			Bottom
B	2" KO[1]	Power Wiring	Side
			Bottom
C	1-5/8" KO	Gas Piping (Front)	
D	1-1/2" KO	Gas Piping (Bottom)	

1. Opening in the bottom to the unit can be located by the side in the insulation.
2. Do not remove the 2" knockout ring.

TABLE 28: MINIMUM CLEARANCES

LOCATION	CLEARANCE
Front	24" (Cooling/Electric Heat) 32" (Gas Heat)
Rear	12" (Less Economizer) 36" (With Economizer or Fixed Air/Motorized Damper)
Left Side (Filter Access)	24" (Less Economizer) 36" (With Economizer)
Right Side (Cond. Coil)	24"
Below Unit[1]	0"
Above Unit[2]	72" (For Condenser Air Discharge)

1. Units may be installed on combustible floors made from wood or class A, B, or C roof covering material.
2. Units must be installed outdoors. Overhanging structures or shrubs should not obstruct condenser air discharge outlet.

TABLE 29: SUPPLY AIR BLOWER PERFORMANCE (DM072 BELT DRIVE) - SIDE DUCT APPLICATION

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive				Standard Drive Option								HIgh Static Drive Option							
1600	811	0.64	895	0.71	974	0.79	1051	0.87	1125	0.96	1196	1.04	1264	1.13	1330	1.23	1393	1.32	1454	1.42
1800	857	0.80	940	0.87	1020	0.95	1097	1.03	1171	1.11	1242	1.20	1310	1.29	1375	1.38	1439	1.48	1500	1.58
2000	907	1.00	990	1.07	1070	1.15	1146	1.23	1220	1.31	1291	1.40	1359	1.49	1425	1.58	1488	1.68	1550	1.77
2200	960	1.24	1043	1.31	1123	1.39	1199	1.47	1273	1.55	1344	1.64	1412	1.73	1478	1.82	1541	1.92	1602	2.01
2400	1015	1.51	1099	1.59	1178	1.66	1255	1.74	1329	1.83	1400	1.92	1468	2.01	1534	2.10	1597	2.19	1658	2.29
2600	1074	1.83	1157	1.90	1237	1.98	1314	2.06	1387	2.14	1458	2.23	1526	2.32	1592	2.41	1656	2.51	1717	2.61
2800	1135	2.18	1218	2.25	1298	2.33	1375	2.41	1448	2.49	1519	2.58	1587	2.67	1653	2.76	1717	2.86	1778	2.96
3000	1198	2.56	1281	2.64	1361	2.71	1438	2.79	1511	2.88	1582	2.96	1651	3.05	1716	3.15	1780	3.24	-	-
																	Field Supplied Drive			

1. Blower performance includes gas heat exchangers and 1" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

TABLE 30: SUPPLY AIR BLOWER PERFORMANCE (DM072 BELT DRIVE) - BOTTOM DUCT APPLICATION

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive				Standard Drive Option								HIgh Static Drive Option							
1600	807	0.65	897	0.72	984	0.79	1068	0.87	1148	0.95	1225	1.04	1300	1.13	1371	1.22	1440	1.31	1507	1.40
1800	856	0.80	947	0.87	1034	0.95	1118	1.02	1198	1.11	1275	1.19	1349	1.28	1421	1.37	1490	1.46	1557	1.56
2000	910	0.99	1001	1.06	1088	1.14	1172	1.22	1252	1.30	1329	1.39	1403	1.47	1475	1.56	1544	1.66	1611	1.75
2200	968	1.23	1059	1.30	1146	1.37	1229	1.45	1309	1.53	1387	1.62	1461	1.71	1533	1.80	1602	1.89	1668	1.99
2400	1029	1.50	1119	1.57	1206	1.65	1290	1.72	1370	1.81	1448	1.89	1522	1.98	1593	2.07	1663	2.16	1729	2.26
2600	1093	1.81	1183	1.88	1270	1.95	1354	2.03	1434	2.11	1511	2.20	1586	2.29	1657	2.38	1726	2.47	1793	2.57
2800	1159	2.15	1250	2.22	1337	2.29	1420	2.37	1500	2.46	1578	2.54	1652	2.63	1724	2.72	1793	2.81	-	-
3000	1228	2.52	1318	2.59	1405	2.67	1489	2.75	1569	2.83	1646	2.91	1721	3.00	1792	3.09	-	-	-	-
																	Field Supplied Drive			

1. Blower performance includes gas heat exchangers and 1" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

TABLE 31: SUPPLY AIR BLOWER PERFORMANCE (DM072 DIRECT DRIVE) SIDE DUCT APPLICATION

UNIT TONNAGE	MOTOR SPEED	AVAILABLE EXTERNAL STATIC PRESSURE - IWG[1]																	
		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
		CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS
6[2]	HI	2461	1480	2402	1440	2361	1395	2260	1350	2178	1305	2101	1260	2000	1205	1914	1155	1830	1110

1. Includes allowances for a wet evaporator coil, 1" filters, and the heat exchangers. Refer to STATIC RESISTANCES Table for resistance values.
2. Side Duct application (230/460/575 Volts)

TABLE 32: SUPPLY AIR BLOWER PERFORMANCE (DM072 DIRECT DRIVE) BOTTOM DUCT APPLICATION

UNIT TONNAGE	MOTOR SPEED	AVAILABLE EXTERNAL STATIC PRESSURE - IWG[1]																	
		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
		CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS
6[2]	HI	2375	1429	2318	1391	2279	1348	2181	1304	2102	1261	2028	1217	1931	1164	1848	1116	1767	1073

1. Includes allowances for a wet evaporator coil, 1" filters, and the heat exchangers. Refer to STATIC RESISTANCES Table for resistance values.
2. Bottom Duct application (230/460/575 Volts)

TABLE 33: SUPPLY AIR BLOWER PERFORMANCE (DF072 BELT DRIVE) - SIDE DUCT APPLICATION

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive				Standard Drive Option								HIgh Static Drive Option							
1600	811	0.64	895	0.71	974	0.79	1051	0.87	1125	0.96	1196	1.04	1264	1.13	1330	1.23	1393	1.32	1454	1.42
1800	857	0.80	940	0.87	1020	0.95	1097	1.03	1171	1.11	1242	1.20	1310	1.29	1375	1.38	1439	1.48	1500	1.58
2000	907	1.00	990	1.07	1070	1.15	1146	1.23	1220	1.31	1291	1.40	1359	1.49	1425	1.58	1488	1.68	1550	1.77
2200	960	1.24	1043	1.31	1123	1.39	1199	1.47	1273	1.55	1344	1.64	1412	1.73	1478	1.82	1541	1.92	1602	2.01
2400	1015	1.51	1099	1.59	1178	1.66	1255	1.74	1329	1.83	1400	1.92	1468	2.01	1534	2.10	1597	2.19	1658	2.29
2600	1074	1.83	1157	1.90	1237	1.98	1314	2.06	1387	2.14	1458	2.23	1526	2.32	1592	2.41	1656	2.51	1717	2.61
2800	1135	2.18	1218	2.25	1298	2.33	1375	2.41	1448	2.49	1519	2.58	1587	2.67	1653	2.76	1717	2.86	1778	2.96
3000	1198	2.56	1281	2.64	1361	2.71	1438	2.79	1511	2.88	1582	2.96	1651	3.05	1716	3.15	1780	3.24	-	-
																	Field Supplied Drive			

1. Blower performance includes gas heat exchangers and 1" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

TABLE 34: SUPPLY AIR BLOWER PERFORMANCE (DF072 BELT DRIVE) - BOTTOM DUCT APPLICATION

Air Flow (CFM)	Available External Static Pressure - IWG[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive				Standard Drive Option								HIgh Static Drive Option							
1600	807	0.65	897	0.72	984	0.79	1068	0.87	1148	0.95	1225	1.04	1300	1.13	1371	1.22	1440	1.31	1507	1.40
1800	856	0.80	947	0.87	1034	0.95	1118	1.02	1198	1.11	1275	1.19	1349	1.28	1421	1.37	1490	1.46	1557	1.56
2000	910	0.99	1001	1.06	1088	1.14	1172	1.22	1252	1.30	1329	1.39	1403	1.47	1475	1.56	1544	1.66	1611	1.75
2200	968	1.23	1059	1.30	1146	1.37	1229	1.45	1309	1.53	1387	1.62	1461	1.71	1533	1.80	1602	1.89	1668	1.99
2400	1029	1.50	1119	1.57	1206	1.65	1290	1.72	1370	1.81	1448	1.89	1522	1.98	1593	2.07	1663	2.16	1729	2.26
2600	1093	1.81	1183	1.88	1270	1.95	1354	2.03	1434	2.11	1511	2.20	1586	2.29	1657	2.38	1726	2.47	1793	2.57
2800	1159	2.15	1250	2.22	1337	2.29	1420	2.37	1500	2.46	1578	2.54	1652	2.63	1724	2.72	1793	2.81	-	-
3000	1228	2.52	1318	2.59	1405	2.67	1489	2.75	1569	2.83	1646	2.91	1721	3.00	1792	3.09	-	-	-	-
																	Field Supplied Drive			

1. Blower performance includes gas heat exchangers and 1" filters. See STATIC RESISTANCE table for additional applications.
2. See RPM SELECTION table to determine desired motor sheave setting and to determine the maximum continuous BHP.
3. kW = BHP x 0.932.

TABLE 35: SUPPLY AIR BLOWER PERFORMANCE (DF072 DIRECT DRIVE) SIDE DUCT APPLICATION

UNIT TONNAGE	MOTOR[1] SPEED	AVAILABLE EXTERNAL STATIC PRESSURE - IWG[2]																	
		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
		CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS
	HI	2256	883	2258	931	2247	950	2223	964	2182	979	2125	971	2044	940	1958	898	1864	854
	MED/HI	2145	771	2127	784	2119	808	2089	826	2051	844	2014	859	1965	861	1896	843	1801	806
6[3]	MED	2020	637	1999	656	1985	675	1947	696	1910	715	1876	730	1832	740	1793	756	-	-
	MED/LOW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	LOW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Factory set on medium speed tap.
2. Includes allowances for a wet evaporator coil, 1" filters, and the heat exchangers. Refer to STATIC RESISTANCES Table for resistance values.
3. Side Duct application (230 Volts)

TABLE 36: SUPPLY AIR BLOWER PERFORMANCE (DF072 DIRECT DRIVE) BOTTOM DUCT APPLICATION

UNIT TONNAGE	MOTOR[1] SPEED	AVAILABLE EXTERNAL STATIC PRESSURE - IWG[2]																	
		0.2		0.3		0.4		0.5		0.6		0.7		0.8		0.9		1.0	
		CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS	CFM	WATTS
	HI	2177	883	2179	931	2169	950	2145	964	2106	979	2051	971	1973	940	1890	898	1800	854
	MED/HI	2071	771	2053	784	2045	808	2016	826	1980	844	1944	859	1897	861	1830	843	-	-
6[3]	MED	1950	637	1929	656	1916	675	1880	696	1844	715	1811	730	1768	740	-	-	-	-
	MED/LOW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	LOW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1. Factory set on medium speed tap.
2. Includes allowances for a wet evaporator coil, 1" filters, and the heat exchangers. Refer to STATIC RESISTANCES Table for resistance values.
3. Bottom Duct application (230 Volts)

TABLE 37: BELT DRIVE RPM SELECTION

Size (Tons)	HP	Max BHP	Motor Sheave	Blower Sheave	5 Turns Open	4 Turns Open	3 Turns Open	2 Turns Open	1 Turn Open	Fully Closed
072 (6)	1.5	1.73	1VL44	AK56	930	995	1060	1130	1195	1260
	3	3.45	1VP56	AK56	1325	1395	1460	1525	1590	1660

TABLE 38: BELT DRIVE BLOWER MOTOR AND DRIVE DATA

MODEL SIZE	MOTOR[1]					Motor Sheave			Blower Sheave			Belt
	HP	RPM	Eff.	SF	Frame	Datum Dia. (in.)	Bore (in.)	Model	Datum Dia. (in.)	Bore (in.)	Model	
6 TON	1-1/2	1725	0.8	1.15	56	2.8 - 3.8	7/8	1VL44	5.2	1	AK56	A36
	3	1725	0.8	1.15	56	4.0 - 5.0	7/8	1VP56	5.2	1	AK56	A38

1. All motors have solid bases and are inherently protected. these motors can be selected to operate into their service factor because they are located in the moving air, upstream of any heating device.

TABLE 39: STATIC RESISTANCES

DESCRIPTION		RESISTANCE, IWG										
		CFM										
		1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000
ECONOMIZER[1,3]		0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.23	0.26	0.30
ELECTRIC HEATERS[1]	7-15KW	0.04	0.05	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.22
	20-30KW	0.06	0.07	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.23	0.26
COOLING ONLY[2]		0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.23	0.26	0.29	0.32

1. Deduct these resistance values from the available external static pressure shown in SUPPLY AIR BLOWER PERFORMANCE Tables.
2. Add these resistance values to the available static resistance values on SUPPLY AIR BLOWER PERFORMANCE Tables.
3. The pressure through the economizer is greater for 100% outdoor air than for 100% return air. If the resistance of the return air duct system is less than 0.25 IWG, the unit will deliver less CFM during full economizer operation.

Drive Selection

1. Determine side or bottom supply air duct application.
2. Determine desired airflow.
3. Calculate or measure the amount of external static pressure.
4. Using the operating point determined from steps 1, 2 & 3, locate this point on the appropriate supply air blower performance table. (Linear interpolation may be necessary.)
5. Noting the RPM and BHP from step 4, locate the appropriate motor and/or drive on the RPM selection table.
6. Review the BHP compared to the motor options available. Select the appropriate motor and/or drive.
7. Review the RPM range for the motor options available. Select the appropriate drive if multiple drives are available for the chosen motor.
8. Determine turns open to obtain the desired operation point.

Example

1. 2200 CFM
2. 1.6 iwg
3. Using the supply air blower performance table below, the following data point was located: 1478 RPM & 1.82 BHP.
4. Using the RPM selection table below, Size X and Model Y is found.
5. 1.82 BHP exceeds the maximum continuous BHP rating of the 1.5 HP motor. The 2 HP motor is required.
6. 1478 RPM is within the range of the 2 HP drive.
7. Using the 2 HP motor and drive, 2.5 turns open will achieve 1478 RPM.

Example Supply Air Blower Performance

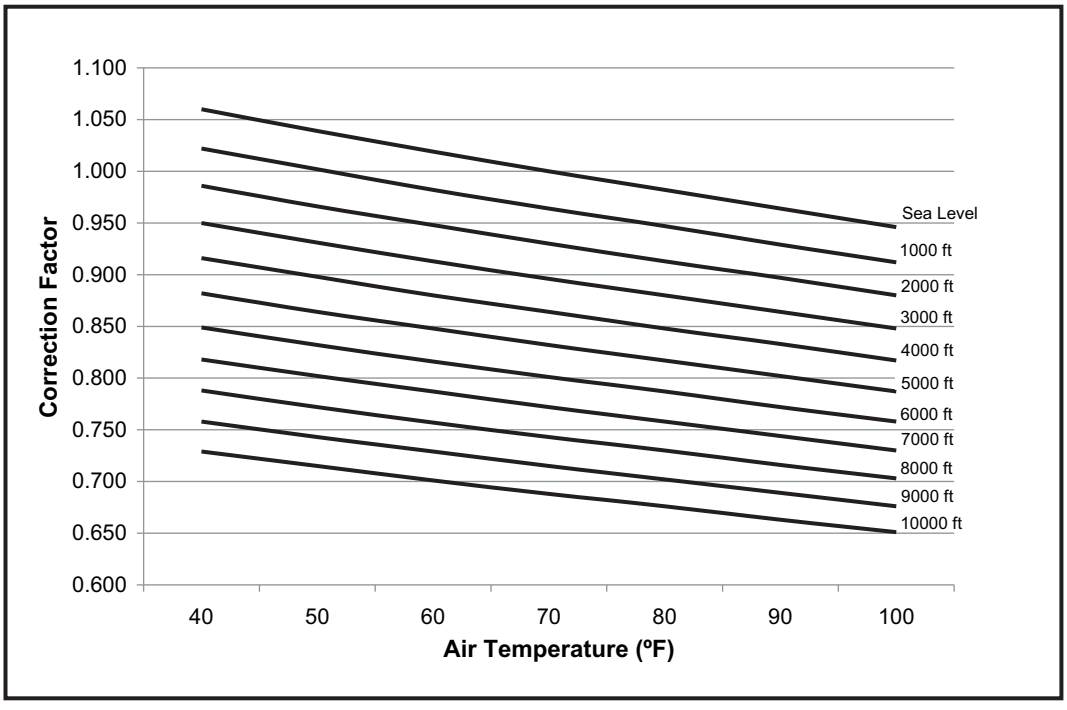
Air Flow (CFM)	Available External Static Pressure - IWG																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field Supplied Drive		Standard Drive Option										HIgh Static Drive Option							
2000	907	1.00	990	1.07	1070	1.15	1146	1.23	1220	1.31	1291	1.40	1359	1.49	1425	1.58	1488	1.68	1550	1.77
2200	960	1.24	1043	1.31	1123	1.39	1199	1.47	1273	1.55	1344	1.64	1412	1.73	1478	1.82	1541	1.92	1602	2.01
2400	1015	1.51	1099	1.59	1178	1.66	1255	1.74	1329	1.83	1400	1.92	1468	2.01	1534	2.10	1597	2.19	1658	2.29
2600	1074	1.83	1157	1.90	1237	1.98	1314	2.06	1387	2.14	1458	2.23	-	-	-	-	-	-	-	-

Table X: RPM Selection

Size (Tons)	Model	HP	Max BHP	Motor Sheave	Blower Sheave	5 Turns Open	4 Turns Open	3 Turns Open	2 Turns Open	1 Turn Open	Fully Closed
X	Y	1.5	1.73	1VL44	AK56	930	995	1060	1130	1195	1260
		2	2.3	1VP56	AK56	1325	1395	1460	1525	1590	1660

Altitude/Temperature Correction Factors

Air Temp.	Altitude (Ft.)										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
40	1.060	1.022	0.986	0.950	0.916	0.882	0.849	0.818	0.788	0.758	0.729
50	1.039	1.002	0.966	0.931	0.898	0.864	0.832	0.802	0.772	0.743	0.715
60	1.019	0.982	0.948	0.913	0.880	0.848	0.816	0.787	0.757	0.729	0.701
70	1.000	0.964	0.930	0.896	0.864	0.832	0.801	0.772	0.743	0.715	0.688
80	0.982	0.947	0.913	0.880	0.848	0.817	0.787	0.758	0.730	0.702	0.676
90	0.964	0.929	0.897	0.864	0.833	0.802	0.772	0.744	0.716	0.689	0.663
100	0.946	0.912	0.880	0.848	0.817	0.787	0.758	0.730	0.703	0.676	0.651



PHASING

Check for proper compressor rotation. If the blower or compressors rotate in the wrong direction at start-up, the electrical connection to the unit is misphased. Change the incoming line connection phasing to obtain proper rotation. (Scroll compressors operate in only one direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or producing a high noise level, the scroll is misphased).

⚠ CAUTION

Scroll compressors require proper rotation to operate correctly. Do not change the internal wiring to make the blower, condenser fans, or compressor rotate correctly. Change the incoming power to the main terminal block to obtain proper rotation.

SUPPLY AIR BLOWERS

These blowers have either multi-speed direct drive motors, or single speed motors equipped with a belt drive. Belt drive units have a variable pitch pulley that allows the blower speed to be adjusted.

CHECKING SUPPLY AIR CFM

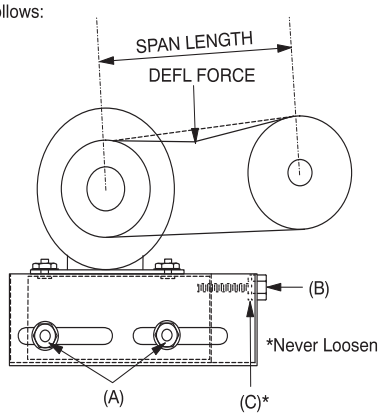
The RPM of the supply air blower will depend on the required CFM, the unit accessories or options and the static resistances of both the supply and the return air duct systems. With this information, the motor speed tap (direct drive) or the motor pulley number of turns open (belt drive) can be determined from the Blower Performance Data Tables.

⚠ CAUTION

Belt drive blower systems MUST be adjusted to the specific static and CFM requirements for the application. The Belt drive blowers are NOT set at the factory for any specific static or CFM. Adjustments of the blower speed and belt tension are REQUIRED. Tighten blower pulley and motor sheave set screws after these adjustments. Re-checking set screws after 10-12 hrs. run time is recommended.

PROCEDURE FOR ADJUSTING BELT TENSION:

1. Loosen nuts (A) (top and bottom).
2. Adjust the tension by turning bolt (B).
3. Never loosen nuts (C) from each other.
4. Use a belt tension checker to apply a perpendicular force to be one belt at the midpoint of the span as shown. The deflection force should be applied until a specific deflection distance of 4mm (5/32") is obtained. To determine the deflection distance from normal position, use a straight edge from sheave to sheave as a reference line. The recommended deflection force is as follows:



Tension new belts at the max. deflection force recommended for the belt section. Check the belt tension at least two times during the first 24 hours of operation. Any re-tensioning should fall between the min. and max. deflection force values.

5. After adjusting, re-tighten nuts (A).

FIGURE 16 - BELT ADJUSTMENT

Note the following:

1. The supply air CFM must be within the limitations shown in the Unit Application Data Table 1.

2. Pulleys can be adjusted in half turn increments.

3. The tension on the belt should be adjusted as shown in the Belt Adjustment Figure 16.

4. Tighten blower pulley and motor sheave set screws after any adjustments. Re-check set screws after 10-12 hrs. run time is recommended.

Start the supply air blower motor. Adjust the resistances in both the supply and the return air duct systems to balance the air distribution throughout the conditioned space. The job specifications may require that this balancing be done by someone other than the equipment installer.

To check the supply air CFM after the initial balancing has been completed:

1. Remove the two 5/16” dot plugs from the blower motor and the filter access panels shown in Figure 15.

2. Insert at least 8" of 1/4 inch tubing into each of these holes for sufficient penetration into the air flow on both sides of the indoor coil.

NOTE: The tubes must be inserted and held in a position perpendicular to the air flow so that velocity pressure will not affect the static pressure readings.

3. Using an inclined manometer, determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil may vary greatly, measuring the pressure drop across a wet coil under field conditions would be inaccurate. To assure a dry coil, the compressors should be deactivated while the test is being run.

4. Knowing the pressure drop across a dry coil, the actual CFM through the unit can be determined from the curve in Pressure Drop vs. Supply Air CFM (Figure 17).

⚠WARNING

Failure to properly adjust the total system air quantity and static pressure can result in extensive system damage.

After readings have been obtained, remove the tubes and reinstall the two 5/16” dot plugs that were removed in Step 1.

NOTE: De-energize the compressors before taking any test measurements to assure a dry indoor coil.

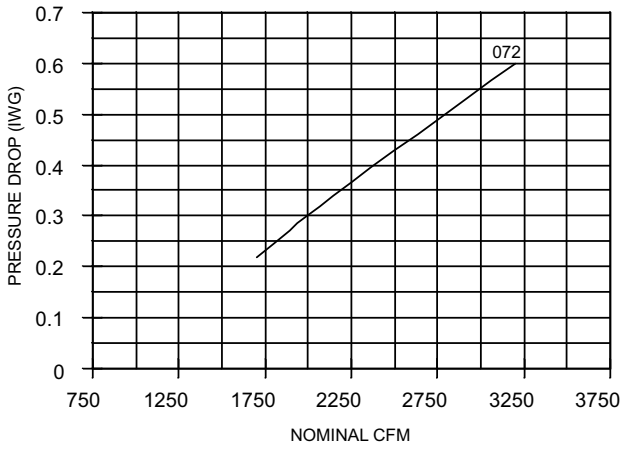


FIGURE 17 - PRESSURE DROP ACROSS COIL

OPERATION

SEQUENCE OF OPERATIONS OVERVIEW

For these units, the thermostat makes a circuit between “R” and “Y1” for the cooling cycle.

The call is passed to the unit control board (UCB), which then determines whether the requested operation is available and, if so, which components to energize.

For gas heating, the UCB monitors the “W1” call but does not handle the operation of the gas furnace. An ignition control board controls the gas heater operation.

For electric heat units, the UCB passes the call to the electric heater.

In both cases, when the “W1” call is sensed, the indoor air blower is energized following a specified heating delay.

If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

COOLING SEQUENCE OF OPERATION

CONTINUOUS BLOWER

By setting the room thermostat fan switch to “ON,” the supply air blower will operate continuously.

INTERMITTENT BLOWER

With the room thermostat fan switch set to “AUTO” and the system switch set to either the “AUTO” or “HEAT” settings, the blower is energized whenever a cooling or heating operation is requested. The blower is energized after any specified delay associated with the operation.

When energized, the indoor blower has a minimum run time of 30 seconds. Additionally, the indoor blower has a delay of 10 seconds between operations.

NO OUTDOOR AIR OPTIONS

When the thermostat calls for cooling, the low-voltage control circuit from “R” to “Y1” and “G” is completed. The compressor and condenser fan motor are ener-

gized. After completing the specified fan on delay for cooling, the UCB will energize the blower motor.

Once the thermostat has been satisfied, it will de-energize Y1. If the compressor has satisfied its minimum run time, the compressor and condenser fan de-energize. Otherwise, the unit operates the cooling system until the minimum run time for the compressor has been completed. After the compressor de-energizes, the blower is stopped following the elapse of the fan off delay for cooling.

To be available, a compressor must not be locked-out due to a high or low-pressure switch or freezestat trip and the anti-short cycle delay (ASCD) must have elapsed.

ECONOMIZER WITH SINGLE ENTHALPY SENSOR

When the room thermostat calls for cooling, the low voltage control circuit from “R” to “G” and “Y1” is completed. The UCB energizes the blower motor (if the fan switch on the room thermostat is set in the “AUTO” position) and drives the economizer dampers from fully closed to their minimum position. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller (previously determined), “Y1” energizes the economizer. The dampers will modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the setpoint, “Y1” energizes the compressor and condenser fan motor only.

Once the thermostat has been satisfied, it will de-energize “Y1”. If the compressor has satisfied its minimum run time, the compressor and condenser fan are de-energized. Otherwise, the unit operates the cooling system until the minimum run times for the compressor has been completed. After the compressor de-energizes, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continues fan operation the economizer damper goes to the min. position.

ECONOMIZER WITH DUAL ENTHALPY SENSORS

The operation with the dual enthalpy sensors is identical to the single sensor except that a second enthalpy sensor is mounted in the return air. This return air sensor allows the economizer to choose between outdoor air and return air, whichever has the lowest enthalpy value, to provide maximum operating efficiency.

ECONOMIZER (SINGLE OR DUAL) WITH POWER EXHAUST

This system operates as specified above with one addition. The power exhaust motor is energized 45 seconds after the actuator position exceeds the exhaust fan setpoint on the economizer control. When the power exhaust is operating, the second stage of mechanical cooling will not operate. As always, the “R” to “G” connection provides minimum position but does not provide power exhaust operation.

MOTORIZED OUTDOOR AIR DAMPERS

This system operation is the same as the units with no outdoor air options with one exception. When the “R” to “G” circuit is complete, the motorized damper drives open to a position set by the thumbnail on the damper motor. When the “R” to “G” circuit is opened, the damper spring returns fully closed.

COOLING OPERATION ERRORS

Each cooling system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum run times for compressors.

HIGH-PRESSURE LIMIT SWITCH

During cooling operation, if a high-pressure limit switch opens, the UCB will de-energize the compressor, initiate the ASCD (Anti-short cycle delay), and, stop the condenser fan. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the compressor.

Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the compressor and flash a code (see Table 46).

LOW-PRESSURE LIMIT SWITCH

The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB will monitor the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30-second monitoring phase, the UCB will de-energize the compressor, initiate the ASCD, and stop the condenser fan.

Once the low-pressure switch has been proven (closed during the 30-second monitor period described above), the UCB will monitor the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the UCB will de-energize the compressor, initiate the ASCD, and stop the condenser fan.

If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the compressor.

Should a low-pressure switch open three times within one hour of operation, the UCB will lock-out the compressor and flash a code (Table 46).

FREEZESTAT

During cooling operation, if a freezestat opens, the UCB will de-energize the compressor, initiate the ASCD, and stop the condenser fan. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the compressor.

Should a freezestat open three times within two hours of operation, the UCB will lock-out the compressor and flash a code (Table 46).

LOW AMBIENT COOLING

To determine when to operate in low ambient mode, the UCB has a pair of terminals connected to a temperature-activated switch set at 45ºF. When the low ambient switch is closed and the thermostat is calling for cooling, the UCB will operate in the low ambient mode.

Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes off. The indoor blower is operated throughout the cycle. The 5-minute off period is necessary to defrost the indoor coil.

Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The defrost cycle will begin immediately following the elapse of the minimum run time.

When operating in low ambient mode, the UCB will not lockout the compressor due to a freezestat trip. However, a freezestat trip will de-energize the compressor. If the call for cooling is still present at the end of the ASCD and the freezestat has closed, the unit will resume operation.

SAFETY CONTROLS

The unit control board monitors the following inputs for the cooling system:

1. A suction line freezestat to protect against low evaporator temperatures due to a low airflow or a low return air temperature, (opens at 26 ± 5 °F and resets at 38 ± 5°F).

2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 380 ± 10 psig and resets at 300 ± 10 psig).

3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 22 ± 5 psig and resets at 45 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration system is monitored and controlled. On any fault, the system will be affected by any safety/preventive action.

The unit control board monitors the temperature limit switch of electric heat units and the temperature limit switch and the gas valve of gas furnace units.

COMPRESSOR PROTECTION

The compressor also has inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the protector will open to shut down the compressor. The UCB incorporates features to minimize compressor wear and damage. An anti-short cycle delay (ASCD) is utilized to prevent operation of a compressor too soon after its previous run. Additionally, a minimum run time is imposed any time a compressor is energized.

The ASCD is initiated on unit start-up and on any compressor reset or lock-out.

FLASH CODES

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 46.

RESET

Remove the call for cooling, by raising thermostat setting higher than the conditioned space temperature. This resets any pressure or freezestat flash codes.

ELECTRIC HEATING SEQUENCE OF OPERATIONS

The following sequence describes the operation of the electric heat section.

Single-stage heating (applies only to 5, 7 & 10 kW 230V heaters and to 7, 10, & 15 kW 460V and 575V heaters. All other heaters MUST use a two-stage thermostat):

a. Upon a call for heat by the thermostat, the heater sequencer (1S) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b. The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

Two-stage heating (applies only to 15, 20 and 30 kW 230V heaters and 20 and 30 kW heater 460V and 575V heaters.):

a. Upon a call for first-stage heat by the thermostat, the heater sequencer (1S) (15, 20, 30 kW 230 volt) and contactor (2M) (20, 30 kW 460 and 575 volt) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

   If the second stage of heat is required, heater sequencer (2S) (12, 20, 30 kW 230 volt) or contactor (3M) (20, 30 kW 460 and 575 volt) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b. The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

SAFETY CONTROLS

The control circuit includes the following safety controls:

1. Temperature Limit Switch (TLS) - This control is located inside the heater compartment and is set to open at the temperature indicated in the Electric Heat Limit Control Setting Table 40. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

TABLE 40: ELECTRIC HEAT LIMIT CONTROL SETTING

VOLTAGE	kW	TEMPERATURE LIMIT SWITCH	OPEN TEMP °F
230-3-60	5	1,2,3	140
	7	1,2,3	140
	10	1,2,3	150
	15	2,4,6	140
	20	1,2,3,4,5,6	150
	30	1,3,5	160
		2,4,6	150
460-3-60	7	2,4,6	140
	10	2,4,6	140
	15	2,4,6	140
	20	3	160
	30	3	160
575-3-60	10	2,4,6	140
	15	2,4,6	140
	20	5	160
	30	5	150

RESET

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes.

HEAT ANTICIPATOR SETPOINTS

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON” cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 41 for the required heat anticipator setting.

TABLE 41: ELECTRIC HEAT ANTICIPATOR SETPOINTS

HEATER KW	VOLTAGE	SETTING, AMPS	
		TH1	TH2
5	230-3-60	0.35	-
7		0.35	-
10		0.35	-
15		0.35	0.19
20		0.35	0.38
30		0.35	0.38
7	460-3-60	0.35	-
10		0.35	-
15		0.35	-
20		0.37	0.29
30		0.37	0.29
10	575-3-60	0.35	-
15		0.35	-
20		0.37	0.29
30		0.37	0.29

GAS HEATING SEQUENCE OF OPERATION

When there is a W1 call for heat, the heat relay (RW1) is energized by the unit control board (UCB). The RW1-1 contacts immediately close energizing the ignition control board (ICB). The ICB checks the state of the flame sense circuit, the roll out switch, the centrifugal switch and the primary / auxiliary temperature limit switch circuit. If they are in the expected state, then the ICB energizes the draft motor and verifies that the centrifugal switch located on the end of the draft motor closes. After the centrifugal switch closes, a 15 second heat exchanger purging period is completed. After this purging period, the ICB will simultaneously energize the pilot gas valve and the ignition coil. Once the flame sensor senses a pilot flame is present, the ignition coil is de-energized. The ICB checks for pilot flame stability and once the ICB is satisfied that the pilot flame is stable, the main gas valve is energized by the ICB. The UCB will energize the indoor blower after a 45 second delay from the call for heat. The ICB and UCB both monitor the furnace safety devices during the furnace operation. When the call for heat is satisfied, the ICB closes the pilot and main gas valves and performs a 30 second purging of the heat exchanger by continuing the operation of the draft motor. The UCB continues the operation of the indoor blower for a configurable amount of time after the call for heat is satisfied.

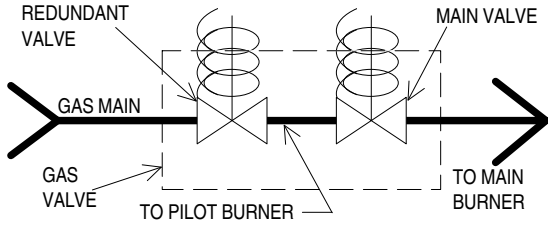


FIGURE 18 - GAS VALVE PIPING

TWO STAGE FURNACE ONLY

If a W1 only call for heat from a two stage thermostat is present, then a two stage furnace will start on high fire for 1 minute and then reduce to low fire until the call for heat is satisfied or a W2 call for heat is received. If a W2 call for heat is received while in low fire operation, then the ICB will immediately move to high fire operation. If a W1 and W2 call for heat is present, then the furnace will remain on high fire operation until the W2 call for heat is satisfied.

Automatic staging of a two stage furnace using a single stage thermostat is possible. To achieve automatic staging of a two stage furnace using a single stage thermostat, cut the 440/GY wire that runs from pin 2 of the S3 connector on the (UCB) unit control board to P2-4 on the ignition control board. Cut the wire 1/2” from the S3 mate-n-lock connector. Wire nut or tape off the 1/2” wire. Attach the other end of the 440/GY wire to the R terminal on the UCB, or to the TB1 power strip.

The unit will operate the same as a W1 only call for heat for 10 minutes. If the call for heat is not satisfied in the 10 minutes, then the ICB will move to high fire operation until the W1 call for heat has been satisfied.

GAS HEAT OPERATION ERRORS

During furnace operation, the ICB monitors the flame sense circuit, the centrifugal switch, the primary limit switch and the roll out switch. If a signal from any of the inputs moves to a fault state, then the ICB immediately closes the pilot and main gas valves. The ICB will determine the device that is signaling a fault and flash a code for that device. A primary limit trip, centrifugal switch trip or flame sense fault triggers a temporary lock out. An auxiliary limit or a roll out switch trip requires intervention to reset the ICB. The UCB also monitors the primary limit and gas valve.

TEMPERATURE LIMITS

The primary limit is located such that the temperature sensitive switch can sense the temperature of the heat exchanger tubes. On single stage models the limit is mounted to the condenser partition panel. On two stage models the limit is mounted just above the inlet of the heat exchanger tubes on the right side. If a primary limit (LS) fault occurs (the primary limit opens due to excessive heat exchanger temperature), then the ICB will flash the appropriate code (Table 47) and monitor the primary limit. The UCB will energize the indoor blower and the ICB will energize the draft motor while the primary limit is open. When the primary limit closes and the call for heat still exists, the ICB will start the ignition sequence over and the UCB will de-energize the blower for 45 seconds. However, the auxiliary limit is in series with the primary limit and it takes first control. If the excessive heat has been high enough to cause the auxiliary limit (AUX) to open, then the ICB will flash the primary limit code but the furnace will not retry ignition during the same call for heat. The auxiliary limit is of the manual reset type and is mounted in the upper right hand corner of the panel between the burner manifold and the flue gas collector box just behind the draft motor. If the auxiliary switch has opened, then special attention should be paid to the primary limit as it may be faulty as well. However, the auxiliary switch is sized such that multiple trips of the primary limit due to complete blower failure will cause enough heat to build up and trip the auxiliary.

If the primary limit opens three times within one hour, then the UCB will lock on the indoor blower and flash a fault code (Table 46).

GAS VALVE

The UCB monitors the gas valve (GV). Any time the UCB senses voltage at the GV without a call for heat for a continuous five-minute period, the UCB will lock on the indoor blower and a flash code on the UCB is initiated (Table 46). When the UCB no longer senses voltage at the GV the UCB will de-energize the indoor blower after the expiration of the indoor blower heating off delay.

If the voltage has been sensed at the GV for at least 15 seconds during the fan on delay for heating and the UCB no longer senses voltage at the GV (W1 call for heat removed or an ICB fault exists), then the UCB forces the indoor blower on for the indoor blower heating off delay.

The gas valve is of the redundant type. If for any reason the main gas valve fails in the open position, then the redundant valve ahead of the main gas valve will shut off the flow of gas to both the pilot and main gas valves.

CENTRIFUGAL SWITCH

The centrifugal switch is mounted on the end of the draft motor and it is an integral part of the motor assembly. On a call for heat, the ICB checks the centrifugal switch (CS) for open state before it energizes the draft motor. If it is closed, then the ICB will lock out the furnace and flash a code (Table 47). If open, then the ICB will energize the draft motor and verify that the switch closes before initiating the purging and ignition sequence. If at any time during furnace operation the centrifugal switch opens, then the ICB will de-energize the pilot and main gas valves and monitor the centrifugal switch. If the centrifugal switch closes and the call for heat still exists, then the ICB will retry the purging and ignition sequence.

ROLLOUT SWITCH

This temperature sensitive switch is located in the burner vestibule just above the right hand side of the burner assembly. In the event of the flame spilling out into the burner manifold area the rollout switch will open, the ICB will close both the main and pilot gas valves and flash a code (Table 47). The ICB will not retry the ignition sequence during the same call for heat.

FLAME SENSE CIRCUIT

The flame sensor is mounted on the left hand side of the burner assembly and is positioned such that the pilot flame surrounds the tip of the sensor. On a call for heat the ICB checks for the flame sense circuit to be open. If open, then the ICB initiates the purging and ignition sequence. Once the pilot flame is present, the ICB monitors the flame sense circuit for pilot flame stability. If the pilot flame is unstable or lost completely, then the ICB will immediately close both the pilot and main gas valves. The ICB will retry the purging and ignition sequence. If the flame is unstable or lost more than 16 times during the same call for heat, then the ICB will lock out furnace operation for 5 minutes.

TABLE 42: SINGLE STAGE GAS HEAT LIMIT CONTROL SETTING

Unit (Tons)	Capacity, MBH		Limit Control Opens, °F	
	Input	Output	Direct Drive	Belt Drive
6	100	80	170	210
6	125	100	165	210

TABLE 43: 2 STAGE GAS HEAT LIMIT CONTROL SETTING

Unit (Tons)	1st Stage Capacity		2nd Stage Capacity		Limit Control Opens, °F	
	Input (MBH)	Output (MBH)	Input (MBH)	Output (MBH)	Direct Drive	Belt Drive
6	45	36	75	61	210	210
6	75	60	125	101	165	210

FLASH CODES

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 46.

RESETS

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes.

HEAT ANTICIPATOR SETPOINTS

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter “ON” cycles and may result in the lowering of the temperature within the conditioned space.

TABLE 44: GAS HEAT ANTICIPATOR SETPOINTS

Gas Valve	Anticipator Setpoint
Honeywell VR8204M	0.60 amp
White-Rodgers 36E36	0.54 amp

START-UP (COOLING)

PRESTART CHECK LIST

After installation has been completed:

1. Check the electrical supply voltage being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Set the room thermostat to the off position.
3. Turn unit electrical power on.
4. Set the room thermostat fan switch to on.
5. Check indoor blower rotation.
   - If blower rotation is in the wrong direction. Refer to Phasing Section in general information section.
   - Check blower drive belt tension.
6. Check the unit supply air (CFM). See “CHECKING SUPPLY AIR CFM” on page 37.
7. Measure evaporator fan motor's amp draw.
8. Set the room thermostat fan switch to off.
9. Turn unit electrical power off.

OPERATING INSTRUCTIONS

1. Turn unit electrical power on.
2. Set the room thermostat setting to lower than the room temperature.
3. Compressor will energize after the built-in time delay (five minutes).

POST START CHECK LIST

1. Verify proper system pressures.
2. Measure the temperature drop across the evaporator coil.
3. Measure the system Amperage draw across all legs of 3 phase power wires.
4. Measure the condenser fan amp draw.

SHUT DOWN

1. Set the thermostat to highest temperature setting.
2. Turn off the electrical power to the unit.

START-UP (GAS HEAT)

PRE-START CHECK LIST

Complete the following checks before starting the unit.

1. Check the type of gas being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Make sure that the vent and combustion air hoods have been properly installed.

OPERATING INSTRUCTIONS

⚠ CAUTION

This furnace is equipped with an intermittent pilot and automatic re-ignition system. DO NOT attempt to manually light the pilot.

TO LIGHT PILOT AND MAIN BURNERS:

1. Turn “off” electric power to unit.
2. Turn room thermostat to lowest setting.
3. Turn gas valve knob or switch to “on” position.
4. Turn “on” electric power to unit.
5. Set room thermostat to desired temperature. (If thermostat “set” temperature is above room temperature, pilot burner ignition will occur and, after an interval to prove pilot flame, main burners will ignite).

TO SHUT DOWN:

1. Turn “off” electric power to unit.
2. Depress knob of gas valve while turning to “off” position or position the switch to the “off” position.

POST-START CHECK LIST (GAS)

After the entire control circuit has been energized and the heating section is operating, make the following checks:

1. Check for gas leaks in the unit piping as well as the supply piping.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warning exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame. use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

2. Check for correct manifold gas pressures. See “Checking Gas Input” on page 47.
3. Check the supply gas pressure. It must be within the limits shown on rating nameplate. Supply pressure should be checked with all gas appliances in the building at full fire. At no time should the standby gas line pressure exceed 13", nor the operating pressure drop below 5.0" for natural gas units. If gas pressure is outside these limits, contact the local gas utility for corrective action.

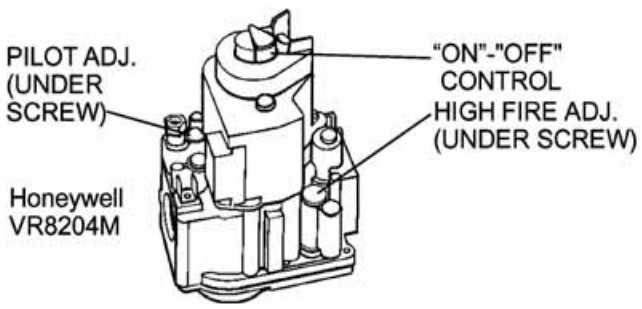


FIGURE 19 - TYPICAL SINGLE STAGE GAS VALVES

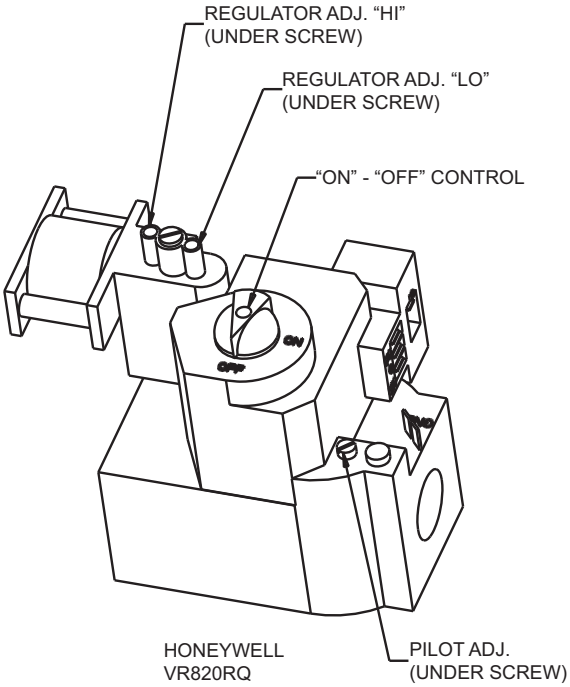


FIGURE 20 - TYPICAL 2 STAGE GAS VALVES

MANIFOLD GAS PRESSURE ADJUSTMENT

Adjustments to the high-fire and low-fire (2 stage) gas flow may be made by turning the pressure regulator adjusting screws on the automatic gas valve.

Adjust as follows:

1. Remove the adjustment screw cap(s) on the regulator.
2. To decrease the gas pressure, turn the adjusting screw counterclockwise.
3. To increase the gas pressure, turn the adjusting screw clockwise.
4. Replace adjustment screw caps.

NOTE: The factory set high-fire manifold pressure for these furnaces is 3.50 IWG. The actual manifold pressure depends on the local fuel heating value.

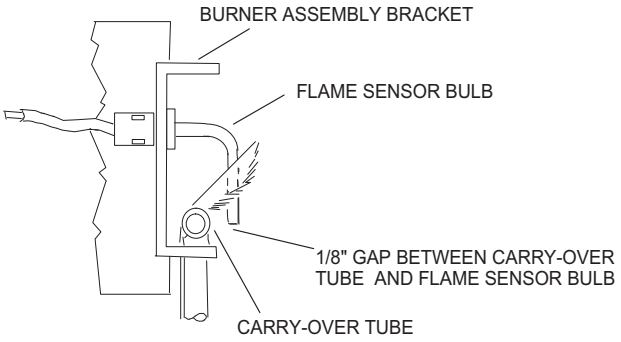


FIGURE 21 - PROPER FLAME ADJUSTMENT

PILOT CHECKOUT

The pilot flame should envelope the end of the flame sensor. To adjust pilot flame, (1) remove pilot adjustment cover screw, (2) increase or decrease the clearance for air to the desired level, (3) be sure to replace cover screw after adjustment to prevent possible gas leakage.

Put the system into operation and observe through complete cycle to be sure all controls function properly.

BURNER INSTRUCTIONS

To check or change burners, pilot or orifices, CLOSE MAIN MANUAL SHUT-OFF VALVE AND SHUT OFF ALL ELECTRIC POWER TO THE UNIT.

1. Remove the screws holding either end of the manifold to the burner supports.
2. Open the union fitting in the gas supply line just upstream of the unit gas valve and downstream from the main manual shut-off valve.
3. Remove the gas piping closure panel.
4. Disconnect wiring to the gas valves and spark ignitors. Remove the manifold-burner gas valve assembly by lifting up and pulling back.

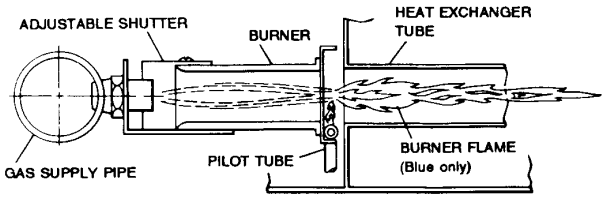


FIGURE 22 - TYPICAL FLAME APPEARANCE

Burners are now accessible for service.

Reverse the above procedure to replace the assemblies. Make sure that burners are level and seat at the rear of the heat exchanger.

BURNER AIR SHUTTER ADJUSTMENT

Adjust burner shutters so no yellow flame is observed in the heat exchanger tubes.

CHECKING GAS INPUT

NATURAL GAS

1. Turn off all other gas appliances connected to the gas meter.
2. With the furnace turned on, measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter usually has a 1/2 or a 1 cubic foot test dial.
3. Using the number of seconds for each revolution and the size of the test dial increment, find the cubic feet of gas consumed per hour from the Gas Rate - Cubic Feet Per Hour (Table 45).

If the actual input is not within 5% of the furnace rating (with allowance being made for the permissible range of the regulator setting), replace the orifice spuds with spuds of the proper size.

NOTE: To find the Btu input, multiply the number of cubic feet of gas consumed per hour by the Btu content of the gas in your particular locality (contact your gas company for this information - it varies widely from city to city.)

TABLE 45: GAS RATE - CUBIC FEET PER HOUR[1]

Seconds for one rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129
30	60	120
32	56	113
34	53	106
36	50	100
38	47	95
40	45	90
42	43	86
44	41	82
46	39	78
48	37	75
50	36	72
52	35	69
54	34	67
56	32	64
58	31	62
60	30	60

1. By actual measurement, it takes 38 seconds for the hand on the 1-cubic foot dial to make a revolution with a 100,000 Btuh furnace running. Using this information, located 38 seconds in the first column in the table above. Read across to the column headed “1 Cubic Foot”, where you will see that 95 cubic feet of gas per hour are consumed by the furnace at that rate. Multiply 95 X 1050 (the Btu rating of the gas obtained from the local gas company). The result is 99,750 Btuh, which is close to the 100,000 Btuh rating of the furnace.

ADJUSTMENT OF TEMPERATURE RISE

The temperature rise (or temperature difference between the return air and the heated air from the furnace) must lie within the range shown on the rating plate and the data in the Gas Heat Application Table 4.

$$CFM = \frac{\text{Btuh Input x } 0.8}{108 \; x \; {}^{o}F \; Temp. \; Rise}$$

After the temperature rise has been determined, the cfm can be calculated as follows:

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts (about six feet from the furnace) where they will not be affected by radiant heat. Increase the blower cfm to decrease the temperature rise; decrease the blower cfm to increase the rise. Refer to the Blower Motor and Drive Data Table 37.

TROUBLESHOOTING

COOLING TROUBLESHOOTING GUIDE

⚠WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

Shut off all electric power to the unit prior to any of the following maintenance procedures to prevent personal injury.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation, which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

On calls for cooling, if the compressors are operating but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in the “AUTO” position).

1. Turn the thermostat fan switch to the ON position. If the supply air blower motor does not energize, go to Step 3.
2. If the blower motor runs with the fan switch in the ON position but will not run after the compressor has energized when the fan switch is in the AUTO position, check the room thermostat for contact between R and G in the AUTO position during calls for cooling.
3. If the supply air blower motor does not energize when the fan switch is set to ON, check that line voltage is being supplied to the contacts of the M2, contactor, and that the contactor is pulled in. Check for loose wiring between the contactor and the supply air blower motor.
4. If M2 is pulled in and voltage is supplied to M2, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on internal protection. Cancel any thermostat calls and set the fan switch to AUTO. Wait for the internal overload to reset. Test again when cool.
5. If M2 is not pulled in, check for 24 volts at the M2 coil. If 24 volts are present at M2 but M2 is not pulled in, replace the contactor.
6. Failing the above, if there is line voltage supplied at M2, M2 is pulled in, and the supply air blower motor still does not operate, replace the motor.
7. If 24 volts is not present at M2, check that 24 volts is present at the UCB supply air blower motor terminal, “FAN”. If 24 volts is present at the FAN, check for loose wiring between the UCB and M2.
8. If 24 volts is not present at the “FAN” terminal, check for 24 volts from the room thermostat. If 24 volts are not present from the room thermostat, check for the following:
   a. Proper operation of the room thermostat (contact between R and G with the fan switch in the ON position and in the AUTO position during operation calls).
   b. Proper wiring between the room thermostat and the UCB.
   c. Loose wiring from the room thermostat to the UCB.
9. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.
10. If the thermostat and UCB are properly wired, replace the UCB.

On a call for cooling, the supply air blower motor is operating but the compressor is not (the room thermostat fan switch is in the “AUTO” position).

1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling and the compressors will not immediately operate. If both stages of cooling are requested simultaneously and the economizer provides free cooling, following a short delay the compressor will be energized unless it is locked out,

unless this option has been disabled through computer communications.

2. If no economizer is installed or the economizer is not opening to provide free cooling and the compressor does not energize on a call for cooling, check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.

3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.

4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts are present and M1 is not pulled in, replace the contactor.

5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.

6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.

7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts is not present from the room thermostat, check for the following:

   a. 24 volts at the thermostat Y1 terminal

   b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2

   c. Loose wiring from the room thermostat to the UCB.

8. If 24 volts is present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.

9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing an alarm code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, cancel any call for cooling. This will reset any compressor lock outs.

NOTE: While the above step will reset any lockouts, the compressor may be held off for the ASCD. See the next step.

10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.

11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 “OUT” terminal of the UCB. If 24 volts is present, trace the wiring from Y1 “OUT” for incorrect wiring. If 24 volts is not present at the Y1 “OUT” terminal, the UCB must be replaced.

12. *For units without economizers*: If 24 volts is present at the Y1 OUT terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 “ECON” terminal.

13. *For units with economizers*: If 24 volts is present at the Y1 “OUT” terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer Mate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from the Mate-N-Lock plug to the Y1 “ECON” terminal. If nothing is found, the economizer actuator may have faulted and is failing to return the 24-volt “call” to the Y1 “ECON” terminal even though the economizer is not providing free cooling. To test, disconnect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB’s Mate-N-Lock plug. If the compressor energizes, there is a fault in the economizer wiring or actuator.

14. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.

15. If none of the above correct the error, replace the UCB.

GAS HEAT TROUBLESHOOTING GUIDE

⚠WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

When not necessary, shut off all electric power to the unit prior to any of the following maintenance procedures so as to prevent personal injury.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation, which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

⚠WARNING

The furnace may shut down on a high temperature condition during the procedure. If this occurs, the UCB energize the supply air blower motor until the high temperature limit has reset. Caution should be used at all times as the supply air blower may energize regardless of the room thermostat fan switch position.

Before beginning symptomatic troubleshooting activities read the flash code LEDs on the unit control board (UCB) and the ignition control board (ICB). Fault codes have a quick sequence of flashes indicating the flash code number followed by a pause with the LED off. The ICB flash codes are repeated until the fault is cleared. The ICB monitors itself, the centrifugal switch, lockout due to > 16 pilot flame losses, primary limit, rollout and a flame present when the ICB expects no flame.

With power applied to the unit, if the LED on the ICB is flashing the heartbeat and the furnace will not operate, then proceed to the symptomatic troubleshooting section. If the ICB LED is not flashing, then perform the ICB troubleshooting procedures. If the ICB has a flash code other than the heartbeat, then determine the flash code and locate its troubleshooting procedures in the flash code troubleshooting section. Refer to Table 47 for flash code identification and component causing fault.

FLASH CODE TROUBLESHOOTING

Power to the unit should be interrupted during the troubleshooting of individual components unless otherwise indicated. All troubleshooting procedures assume the unit is wired per the wiring diagram. If there is any indication the unit has been previously repaired, then the first priority is to verify that the furnace is wired per the wiring diagram. Mis-wired units will give false flash codes.

IGNITION CONTROL BOARD

The ICB controls the ignition of the pilot, the opening and closing of the gas valves and the operation of the draft (inducer) motor. It also monitors all the furnace safety components.

If the ICB LED is on steady, then verify the wiring of the unit to the wiring diagram and if ok, then replace the ICB. If the unit has power and the ICB LED is not flashing, then remove the 3 pin connector (single stage gas heat) or 4 pin connector (2 stage gas heat) from the ICB. Measure the control voltage between terminals 1 and 2 of the wiring harness connector. The control voltage must be between 18 and 30 volts. If control voltage is not present, then check the 3.2A circuit breaker to verify that the circuit breaker has control voltage on both input and output terminals. If control voltage is present on the input and not the output of the circuit breaker, then reset or replace the circuit breaker as necessary. If control voltage is present on both sides of the circuit breaker, then check the power and common wires between the unit control box and the ICB and repair as necessary. If the control voltage is present, then verify the cleanliness of the harness and the ICB connector, clean if necessary and reconnect the wiring harness to the ICB and observe ICB LED. If it now flashes the heartbeat, then the fault was a bad connection between the harness connector and the ICB connector or a broken wire exists in the harness. With the harness connected to the ICB, gently move the wires in the harness while observing the ICB LED. If heartbeat is steady, then verify proper operation of the furnace. If the ICB does not flash the heartbeat, then gently move the wires in the harness connector while observing the ICB LED. If you get any flashes of the ICB LED, then there is still a bad connection or a broken wire. If no flashes are seen while gently moving the wires with the harness connected to the ICB, then replace the ICB and verify proper operation of the furnace.

CENTRIFUGAL SWITCH

The centrifugal switch is an integral part of the draft motor. The centrifugal switch closes when the motor speed increases to ~2500 rpm and opens when the motor speed descends to ~2000 rpm.

If a flash code indicates the centrifugal switch is causing a fault, then

1. If the flash code indicates the switch is open with the draft (inducer) motor on (flash code 2), then
   a. Disconnect power to the unit. Using a screw driver, spin the draft motor blower wheel. If bound or dragging, then visually inspect the draft motor blower wheel area for debris. If debris is present, then clear debris and verify proper furnace operation. If clear, then replace the draft motor and verify proper furnace operation.
   b. Restore power to unit and induce a call for heat. Measure the voltage across the two draft motor leads (white and red on single stage models and white and black on two stage models). If it is less than 177 volts, then check and repair the power circuit to the draft motor. If the voltage is greater than 176 volts and the draft motor is not turning, then disconnect power and draft motor power leads. Measure the resistance of the draft motor windings. If an open circuit exists in the motor, then replace the draft motor. If the voltage is greater than 176 volts and the motor is turning, then check the centrifugal switch wiring between the ICB and the draft motor. If ok, then disconnect power to the unit and place the gas valve in the off position. Prepare to temporarily jumper the wires connected to terminals 3 and 8 of the ICB 9 pin harness connector by disconnecting the draft motor leads from the 9 pin harness. Restore the power to the unit and induce a call for heat. Jumper wires 3 and 8. If the ignition sequence is started after 15 seconds (audible sparking of the igniter), then replace the draft motor reconnecting the centrifugal switch wiring per the wiring diagram. If not, then replace the ICB, remove the jumper and reconnect the centrifugal switch wiring per the wiring diagram. Place the gas valve in the on position and verify proper furnace operation.
2. If the flash code indicates the switch is closed with the draft (inducer) motor off (flash code 3), then disconnect the 9 pin connector from the ICB and measure the continuity of the centrifugal switch with a battery powered test light or an ohm meter between terminals 3 and 8 of the harness connector. If a closed circuit is indicated, then check the wiring between the ICB and the draft motor. If the wiring is not shorted together, then replace the draft motor. If an open circuit is indicated, then reconnect the 9 pin wiring harness to the ICB and remove power to the unit for at least 20 seconds. Restore power to the unit. If the ICB continues to flash a code 3, then replace the ICB.

PILOT FLAME LOCKOUT

The ICB counts the number of flame losses during the same call for heat. If more than 16 flame losses occur within the same call for heat, then the control temporarily locks out furnace operation for 5 minutes (flash code 5). If the call for heat remains after the 5 minutes, then the ICB will retry the ignition sequence. The flame losses can be due to low inlet pressure, debris around flame sensor, plugged pilot burner, soot on the surface of the flame sensor or misadjusted pilot pressure. Remove the power to the unit for 20 seconds and then restore power to the unit. Induce a call for heat and observe the pilot flame in the flame sensor area to determine the best course of action.

1. If the flame is strong and stable in the flame sensor area, then verify the position of the flame sensor per the start up procedures. If ok, then remove the flame sensor and check the cleanliness of the electrode. If clean, then replace the flame sensor and adjust pilot per the start up procedures. If not clean, then clean, reinstall and adjust pilot per the start up procedures.

2. If the flame is weak or unstable in the flame sensor area, then verify the gas inlet pressure. If gas inlet pressure is above the minimum inlet pressure stated on unit data label, then adjust the pilot pressure per the start up procedures. If the pilot cannot be adjusted to obtain a strong and stable flame in the flame sensor area, then remove the burner assembly and verify the pilot burner assembly is open internally and the holes in the burner are clean. Check the pilot orifice size to the unit data plate and the cleanliness of the pilot orifice. Verify that the flame sensor electrode is clean and is adjusted properly. After cleaning or replacement of the pilot assembly components, reinstall the burner assembly and adjust pilot per the start up procedure.

PRIMARY OR AUX TEMPERATURE LIMIT

The temperature limits limit the temperature in the furnace to a safe level. If a temperature higher than the preset limit is achieved due to low or no air flow through the furnace, then the temperature limits opens and the ICB closes the gas valve and flashes code 6. The primary limit is automatic reset type while the auxiliary limit is manual reset type. If either one opens, then the ICB removes power to the gas valve and the UCB energizes the indoor blower until the primary limit automatically resets or the auxiliary limit is manually reset. Verify adequate air flow through the furnace. If air flow is nonexistent or weak, then troubleshoot and repair the conditioned space air circulation system as necessary. Reset the auxiliary limit and verify proper operation of the furnace. If airflow is normal, then verify the gas input rate to the furnace following the start up procedures (auxiliary limit must be reset before the furnace will operate). If after verifying the circulating air system, the input rate to the furnace and that the air temperature rise through the furnace is within the rise range on the unit data plate the flash code still exists, then set the gas valve to the off position and temporarily apply control voltage (~24 volts) to pin 9 of the 9 pin ICB connector. With power applied to the unit, if the ICB LED continues to flash a code 6, then replace the ICB and return unit to operation (you must remove the temporary voltage to pin 9 before the gas valve is turned on). If the ICB LED flashes a heartbeat, then replace the limit that is opening, remove the temporary voltage applied to pin 9, turn on the gas valve, restart the furnace and verify proper operation of the furnace.

ROLLOUT SWITCH

The rollout switch is installed to protect the furnace from damage due to excessive heat in the burner area. There are 4 main reasons the rollout switch will open (flash code 7) due to excessive heat in the burner area. You must remove power to the unit for 20 seconds to reset the ICB.

1. A blocked flue outlet is the most common cause for the rollout switch to open. Check the flue outlet for debris and clear if necessary.

2. Loose blower wheel on draft motor. Verify that the blower wheel is securely fastened to the draft motor shaft.

3. Unit operating outside the air temperature rise range stated on the unit data plate. Either the air flow through the furnace is not sufficient or the gas input rate to the furnace exceeds the recommended rate. Verify both conditions are within the published ranges.

4. Cracked heat exchanger tube(s). If a heat exchanger tube or tubes is cracked, then the flow through the heat exchanger is restricted and the flame will either roll out of the tube inlet or heat will build to an abnormal level in the burner area. This can usually be determined by observing burner flame with and without indoor blower operation. If the flame changes when the blower is running

compared to when it is not, then visually inspect the heat exchanger tubes.

If all of the above are found to be in good condition or within the operating ranges, then set the gas valve to the off position and temporarily apply control voltage (~24 volts) to pin 6 of the 9 pin ICB connector. With power applied to the unit, if the ICB LED continues to flash a code 7, then replace the ICB and return unit to operation (you must remove the temporary voltage to pin 6 before the gas valve is turned on). If the ICB LED flashes a heartbeat, then replace the rollout switch, remove the temporary voltage applied to pin 6, turn on the gas valve, restart the furnace and verify proper operation of the furnace.

UNEXPECTED FLAME PRESENCE

If a flame is present without a call for heat (flash code 8), then the ICB will continue operation of the draft motor and the UCB will call for indoor operation when either of the temperature limit opens. If the unit is correctly wired and there is not a call for heat, then check for control voltage to the gas valve. If control voltage exists at the gas valve, then replace the ICB. If voltage is not present at the gas valve, then replace the gas valve.

GAS VALVE STUCK OFF OR ON

If the pilot and/or the main valves are sensed to be off more than 1 second when commanded to be on, the control will shut off all outputs and enter a hard lockout (flash code 9). Likewise, if the pilot and/or the main valves are sensed to be on more than 1 second when commanded to be off, the control will shut off all outputs and enter a hard lockout (flash code 9). The control will not respond to the thermostat demands during a hard lockout. The only way to recover from a hard lockout is to remove and reapply 24VAC power to the control.

FLAME SENSE CIRCUIT FAILURE

If the control detects an internal hardware failure in the flame sense circuit, it shuts off all outputs and enters a hard lockout (flash code 10). The control will not respond to thermostat demands during a hard lockout. The only way to recover from a hard lockout is to remove and reapply 24VAC power to the control. If problem persist after removal and reapplication of 24VAC power, the board may need to be replaced.

SYMPTOMATIC TROUBLESHOOTING

On calls for heating, the draft motor operates and the furnace lights but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in “AUTO” position).

1. Place the thermostat fan switch in the “ON” position. If the supply air blower motor energizes, go to Step 10.
2. If the supply air blower motor does not energize when the fan switch is set to “ON,” check that line voltage is being supplied to the contacts of the M2 contactor, and that the contactor is pulled in. Check for loose wiring between the contactor and the supply air blower motor.
3. If M2 is pulled in and voltage is supplied at M2, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on inherent protection. Cancel any thermostat calls and set the fan switch to “AUTO”, wait for the internal overload to reset. Test again when cool.
4. If M2 is not pulled in, check for 24 volts at the M2 coil. If 24 volts is present at M2 but M2 is not pulled in, replace the contactor.
5. Failing the above, if there is line voltage supplied at M2, M2 is pulled in, and the supply air blower motor still does not operate, replace the motor.
6. If 24 volts is not present at M2, check that 24 volts is present at the supply air blower motor terminal on the UCB. If 24 volts is present at the UCB terminal, check for loose wiring between the UCB and M2.
7. If 24 volts is not present at the UCB supply air blower motor terminal, check for 24 volts from the room thermostat. If 24 volts is not present from the room thermostat, check for the following:
   a. Proper operation of the room thermostat (contact between R and G with the fan switch in the “ON” position and in the “AUTO” position during operation calls).
   b. Proper wiring between the room thermostat and the UCB.
   c. Loose wiring from the room thermostat to the UCB.
8. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.

9. If the thermostat and UCB are properly wired, replace the UCB.

10. If the blower motor runs with the fan switch in the “ON” position but does not run shortly after the furnace has ignited when the fan switch is in the “AUTO” position, check the room thermostat for contact between R and G during “W1” calls.

On calls for heating, the supply air blower operates but the draft motor does not (the room thermostat fan switch is in the “AUTO” position).

1. The draft motor has inherent protection. If the motor shell is hot to the touch, wait for the internal overload to reset.

2. If the motor shell is cold with the room thermostat calling for heat, check if 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat “W1” terminal is connected to the “W1” terminal of the UCB, and for loose wiring.

3. The draft motor is a 230 volt draft motor on all models regardless of unit supply voltage. If the ICB is flashing a code other than the heartbeat, then troubleshoot the device indicated by the fault code. If not, then remove power to the unit for more than 20 seconds. If upon restoring the power to the unit the draft motor does not start with a call for heat, then verify that terminal “L1” of the ICB has a minimum of 120 volts to ground on 230 and 460 volt models or a minimum of 18 volts to ground on 575 volt models. If terminal “L1” does not have the minimum voltage, then check the wiring between the unit control box and the ICB on all models and on 460 volt models, the transformer in the gas heat compartment and its wiring. If terminal “L1” does have the minimum voltage, then check for the minimum voltage on terminal “IND” of the ICB on single stage models and terminal “IND HIGH” of the ICB on two stage models. If voltage is not present at the terminal, then verify wiring between the control box and the ICB. If all wiring is intact, then ICB is at fault. If voltage is present at the terminal on 230 and 460 volt models, then the draft motor is at fault. On 575 volt models, if voltage is present at the terminal, then check the draft motor relay (DMR on single stage gas heat and DMR-2 on two stage gas heat) mounted above the ICB. First verify that the relay is pulled in by visual inspection. If not, then verify the minimum voltage is present between terminals “A” and “B” of the relay. If the minimum voltage is not present, then check the wiring. If it is present, then verify that a minimum of 150 volts is present at terminals “5” and “7” of the draft motor relay. If not present at terminal “7” of the draft motor relay, then troubleshoot the transformer in blower section and its wiring. If present at terminal “7” and not at terminal “5” of the draft motor relay, then the relay is at fault. If the minimum voltage is present at terminal 5 of the draft motor relay, then the draft motor is at fault.

The ignitor sparks at the pilot burner but the pilot does not ignite and a gas odor is detected at the draft motor outlet.

1. Adjust the pilot adjust screw on the gas valve as described in “PILOT CHECKOUT” on page 47.

2. Check the supply pressure as described in “POST START CHECK LIST” on page 46. Make adjustments as necessary.

3. Check the pilot orifice and pilot burner for obstruction as described in paragraph above. Clean as needed but the problem should not be the gas valve.

The pilot burner ignites but the ignitor continues to spark and the main burners do not ignite.

1. Make the same checks and adjustment as described in “PILOT CHECKOUT” on page 47.

2. Check the supply pressure as described in “POST START CHECK LIST” on page 46. Make adjustments as necessary.

3. Make sure that the pilot burner is not bent or damaged.

4. Make sure that the ground connections at the pilot burner, gas valve and ignition control are intact. Check the ignitor wire for good electrical connection. If all are intact, replace the ignition control.

The pilot burner lights and the spark stops but the main burners do not light.

1. Check electrical connections between the ignition control and the gas valve. If intact, check for 24 volts across terminals “MV” and “GROUND” terminals. If no voltage detected, replace ignition control. If voltage is present, replace gas valve.

Main burners light but exhibit erratic flame characteristics.

1. Adjust air shutters as described in “BURNER AIR SHUTTER ADJUSTMENT” on page 47.

2. Check the main burner orifices for obstruction and alignment. Removal procedure is described in BURNER INSTRUCTIONS on page 47. Clean or replace burner orifices and burners as needed.

UNIT FLASH CODES

Various flash codes are utilized by the unit control board (UCB) and the ignition control board (ICB) to aid in troubleshooting. Flash codes are distinguished by the short on and off cycle used (approximately 200ms on and 200ms off). To show normal operation, the control boards flashes a 1 second on, 1 second off “heartbeat” during normal operation. This is to verify that the UCB and the ICB are functioning correctly. Do not confuse this with an error flash code. To prevent confusion, a 1-flash, flash code is not used.

Current alarms or active restrictions are flashed on the UCB LED.

- **LAST ERROR** - When this button is pressed and released one time within five seconds, it flashes the last five flash codes on the board’s LED. The most recent alarm is shown first and the oldest alarm is shown last.

  When pressed and released twice within a five second span, the fault history is cleared.

- **TEST RESET** - When this button is pressed and released one time within five seconds, any anti-short cycle delays (ASCD) is bypassed for one cycle.

  When this button is pressed twice within five seconds, any active lockouts are reset.

- **COMM SET UP** - If the board is to be networked with other units, this button is used to set the network address.

  The first time the button is pressed within five seconds, it scans the bus, then assign itself the first available address {starts at 2}. It then flashes that address one time.

  Pressing the button two times within five seconds causes the control to flash its address.

  Pressing the button three times within five seconds forces the control to reset its address to one, which is the factory default.

Current alarms or active restrictions are flashed on the ICB LED. No history is stored on the ICB.

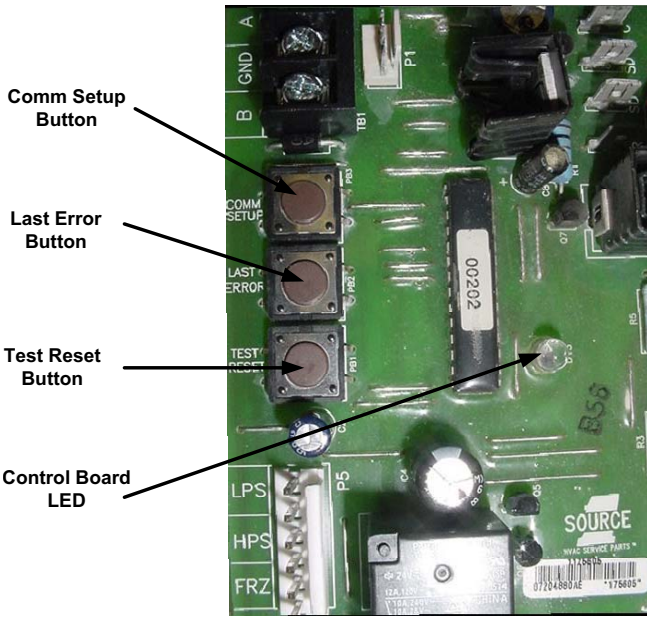


FIGURE 23 - UNIT CONTROL BOARD

FAN ON AND OFF DELAYS

The fan on and off delays can be field adjusted by pressing a combination of buttons on the UCB.

- **Gas Heat Option #1** - Press the **LAST ERROR** and **TEST RESET** buttons simultaneously and then release. The control flashes three times as it writes a 30 second delay ON and a 90 second delay OFF to the program.
- **Gas Heat Option #2** - Press the **COM SET UP** and **TEST RESET** buttons simultaneously and then release. The control flashes four times as it writes a 30 second delay ON and a 180 second delay OFF to the program.
- **Electric Heat** - Press and release the **COMM SETUP** and **LAST ERROR** buttons at the same time. The control flashes twice on the LED as the control writes a 0 second ON and a 30 second OFF fan delay to the control's program memory.

TABLE 46: UNIT CONTROL BOARD FLASH CODES

Flash Code	Description
On Steady	Control Failure - Replace Control
Heart Beat	Normal Operation
1 Flash	Not Applicable
2 Flashes	Control waiting ASCD[1]
3 Flashes	HPS1 - Compressor Lock out
5 Flashes	LPS1 - Compressor Lock out
7 Flashes	FS1 - Compressor Lock out
9 Flashes	Ignition Control Locked Out/ Ignition Control Failure / Limit Switch Trip / No Jumper Plug in Heat Section
10 Flashes	Compressors Locked Out On Low Outdoor Air Temperature[1]
11 Flashes	Compressors Locked Out Because The Economizer Is Using Free Cooling[1]
13 Flashes	Compressor Held Off Due To Low Voltage[1]
14 Flashes	EEPROM Storage Failure (Control Failure)
OFF	No Power or Control Failure

1. These flash codes do not represent alarms.

TABLE 47: IGNITION CONTROL BOARD FLASH CODES

Flash Code	Description
Heart Beat	Normal Operation
1 Flash	Not Applicable
2 Flashes	Pressure / Centrifugal Switch Open with Inducer On
3 Flashes	Pressure / Centrifugal Switch Closed with Inducer Off
4 Flashes	Not Applicable
5 Flashes	Lock Out From Too Many Flame Losses
6 Flashes	High Temperature Switch Open (Primary or Aux.)
7 Flashes	Rollout Switch Open
8 Flashes	Flame Present With Gas Off
9 Flashes	Gas Valve Stuck Off or On
10 Flashes	Flame Sense Circuit Failure

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